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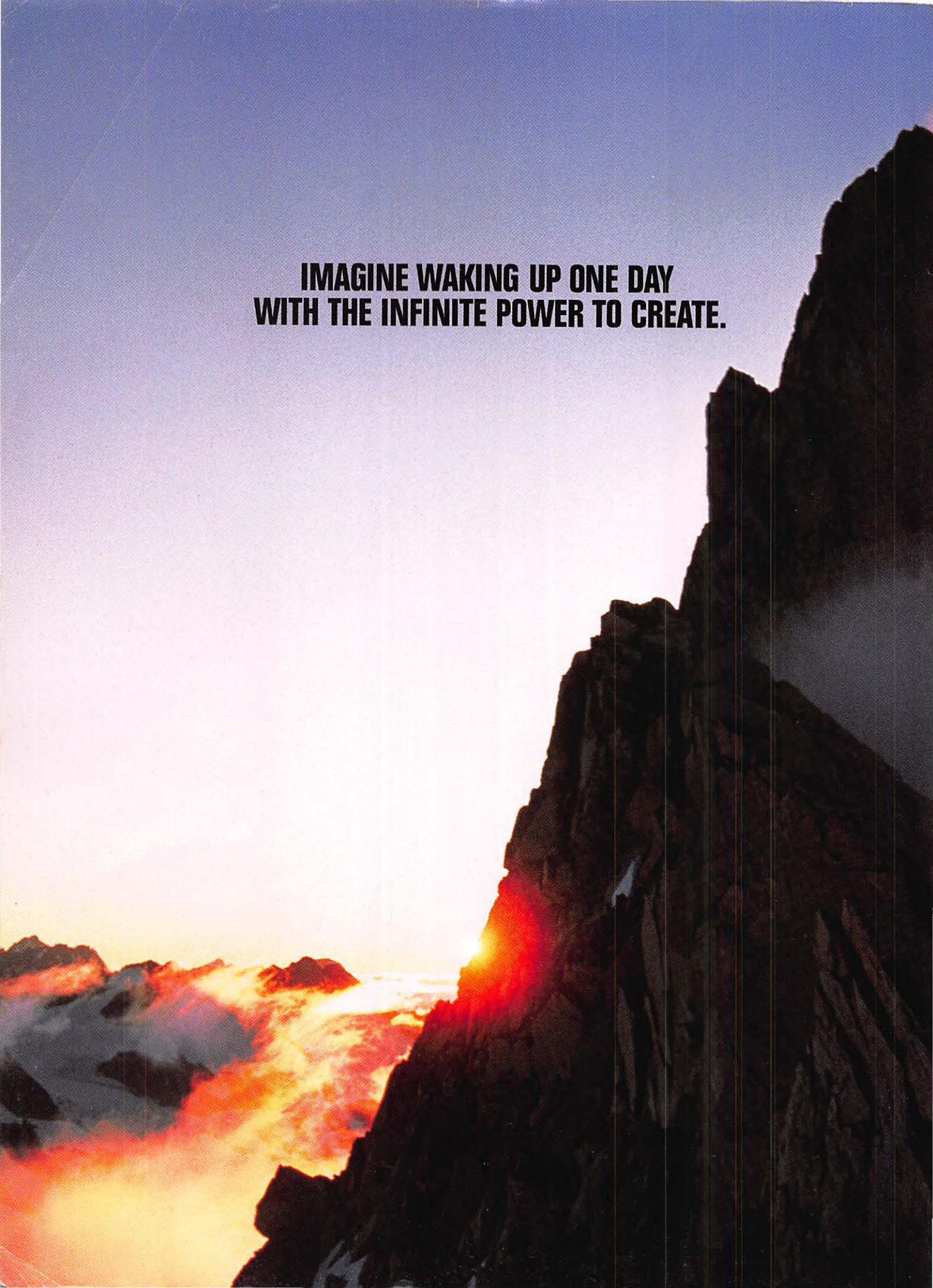
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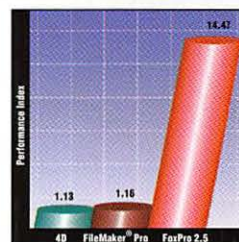
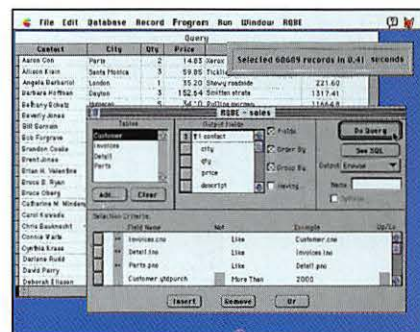
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Contents

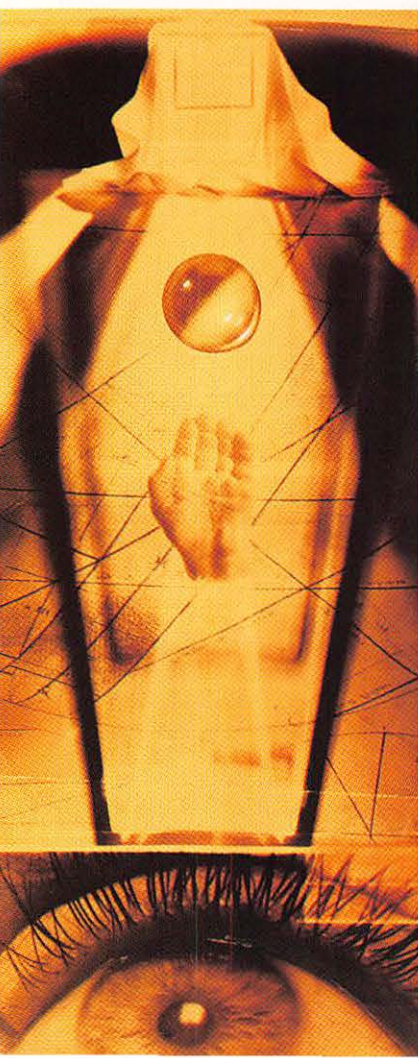
MACWORLD THE MACINTOSH® MAGAZINE FEBRUARY 1994

Special 10th Anniversary Issue

As the Macintosh reaches this important milestone, Macworld celebrates a decade of the Mac's pioneering spirit, innovative design, and memorable accomplishments—and envisions its future direction.

ON THE COVER

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21 State of the Mac

BY ADRIAN MELLO Taking stock of the Mac's past, present, and future.

86 Macintosh Innovations

BY GALEN GRUMAN AND JIM HEID From the beginning, the Mac's radical design transcended prevailing PC technology—transforming the way we perceive computers. Now, with the PowerPC, its evolution continues.

102 PowerPC Preview

BY LON POOLE This RISC-based processor is poised to break through the Mac's current performance ceiling. Here's what to expect from the first generation of the Mac's new family of CPUs.

112 Macintosh Mystique

BY CHARLES PILLER It was designed as a powerful but easy-to-use tool for creative communication, but did the Macintosh deliver on its other big promise—to empower the individual and change the world?

199 The Desktop Critic

BY DAVID POGUE At the ten-year mark, who are the software survivors?

205 The Iconoclast

BY STEVEN LEVY Honoring the Macintosh: its influence reigns supreme.

312 Wise Guy

BY GUY KAWASAKI How Apple could have vanquished its arch-rival.

10
Macworld
INTO THE NEXT DECADE

Features

- 124 Workgroup Printers**
BY GENE STEINBERG Macworld Lab rates 16 models for features, price, and performance.



News

- 33 MacBulletin**
- 34 News** Apple's Mac/DOS system • Native PowerPC apps, and more
- 41 New Products**

Opinion

- 25 Letters**
- 213 Conspicuous Consumer**
BY DEBORAH BRANSCUM Industry saints and sinners.

Graphics

- 134 News** DayStar's Photoshop automation • Leaf's digital camera/scanner, and more
- 138 Expert Graphics**
BY CATHY ABES Graphics professionals share their secrets.
- 142 Make Great Scans**
BY STEVE ROTH How to capture the sharpest scans and turn them into high-quality output.

At Work

- 150 News** FoxPro for Mac • Persuasion upgrade, and more
- 155 Working Smart**
BY JIM HEID Practical graphing techniques.
- 160 Integrated Software**
BY JOSEPH SCHORR The best all-in-one programs.
- 169 Quick Tips**
BY LON POOLE Tips, tricks, and shortcuts.



Page 124

Networks

- 180 News** ARA revamped • Affordable SMDS • DaVinci's cross-platform E-mail, and more
- 182 SNMP Revealed**
BY JOEL SNYDER How Mac networks can benefit from the Simple Network Management Protocol.
- 191 PowerBook Notes**
BY CARY LU Printing on the road.

Buyers' Tools

- 217 Editors' Choice**
Top picks from our comparative articles.
- 221 Star Ratings**
More than 350 product-review summaries.
- 245 Streetwise Shopper**
Hardware and software bargains: discounts, bundles, upgrades.

- 14 How to Contact Macworld**



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Reviews

- 52 PowerBook Duo 270c**
Active matrix notebook computer
- 54 NuTek Duet**
Mac work-alike
- 57 Authorware Professional 2.0.1**
Multimedia scripting/presentation software
- 59 DateBook and TouchBase Pro Bundle**
Calendar manager
- 61 Infini-D 2.5.1; StrataVision 3d 2.6.3**
3-D design applications
- 63 Smalltalk/V for Macintosh 2.0**
Object-oriented development environment
- 64 Elastic Reality 1.0**
QuickTime morphing and warping
- 65 CSC ChemOffice 2.0**
Comprehensive chemistry software
- 66 QuickFlix 1.0**
QuickTime moviemaking application
- 67 Delrina FaxPro for Macintosh 1.0**
Fax software
- 75 Avid VideoShop 2.0**
QuickTime video-editing program
- 77 Expert Pad PI-7000**
Personal digital assistant
- 79 Turing's World 3.0**
Computer-science educational software
- 79 TrakMate**
Input device
- 81 Silver Cloud 1.2**
Network-management software
- 81 CryptoMactic 1.0.1**
Security software
- 83 MacInteriors**
Interior design software
- 83 MacGrade 1.5.5**
Gradebook program

They put a big red crayon in your hand.

Now what? Aa Bb Cc Dd Ee Ff. Again and again. Is it K or X? May
I go to the bathroom, please? Reececess!

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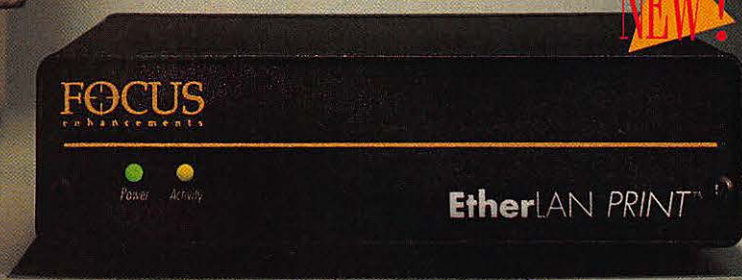
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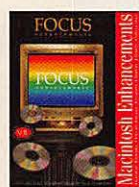
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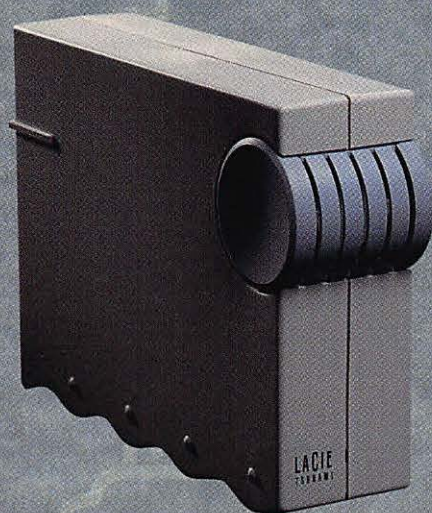
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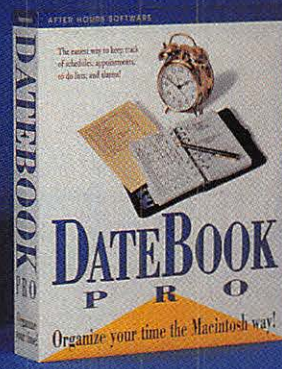
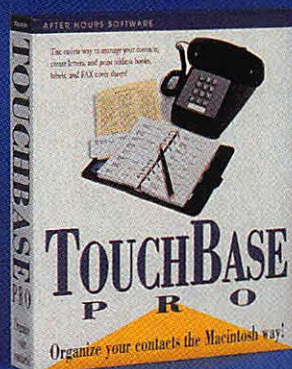
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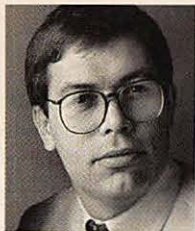
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Into the Next Decade

Reckoning the Mac's momentum

TEN YEARS AGO, ON JANUARY 24, 1984, Apple unveiled the Macintosh. The arrival of the Mac was one of the two most important events in the last 15 years of personal computing. The other event was the appearance of the IBM PC about two years earlier, which legitimized personal computers and inaugurated the widespread DOS operating system. The Macintosh has offered the only viable alternative to DOS computing. In an industry distinguished by fast-paced innovation, the Mac has been the key force of technological progress. Consider the now widespread adoption of the graphical user interface, the drive toward plug-and-play computing, and other concepts popularized by the Mac.

On the same day that Apple unveiled the Macintosh, *Macworld* magazine appeared alongside the new computer—making *Macworld* the only major computer magazine that debuted on the same day as the system it covers. From the very beginning, *Macworld* has been committed to the Macintosh and the intelligence of its approach to computing. As the Macintosh moves forward into the next decade, *Macworld* is more committed than ever to the Mac and to keeping you informed of all its significant developments.

We mark this anniversary by taking stock of the machine's accomplishments, its missteps, and its impending future. We start with "Macintosh Innovations" by senior associate editor Galen Gruman and contributing editor Jim Heid, which chronicles the Mac's evolution while answering many key questions. In the last ten years what has made the Mac unique? When has the Mac been successful and when has it gone astray? What has the Mac contributed in the way of technology? In what ways does the Mac need to transform as it enters the next decade?

Planetary Alignments

Often an anniversary is only a mathematical eventuality. But the Mac's tenth birthday is surrounded by portentous events, as if all the planets were lining up for some

defining moment. Last summer began with an eclipse casting a long shadow on Apple's future. Disappointing financial returns, changes in top management, and the layoff of 2500 workers darkened confidence in Apple's long-term prospects.

Another more ambiguous planet fell into alignment at the Newton's introduction last August. The Newton is Apple's first major new computing device since the introduction of the Mac. The Newton has been justly criticized as a promising technology that was prematurely offered as a product. Apple called on its own past to rationalize the Newton's lack of practical application by comparing it to the original 128K Mac. This comparison was unfortunate because the 128K Mac was a more useful machine from the outset (you could easily create written and graphical

structuring to become a low-cost producer, Apple has finally reached (and perhaps exceeded) price/performance parity with comparable DOS computers. Apple's new machines are as fast as the Quadra 700, which was Apple's fastest model when it was introduced a mere two years ago, but the 700 went for six to eight times the price of the Quadra 605. It's taken ten years, but new Mac models offer nearly the same price/performance as PCs.

PowerPC's Sphere of Influence

The greatest planet is hovering on the horizon. The Mac's tenth anniversary falls just before the dawn of PowerPC-based Macs. PowerPC lies at the very heart of a new high-performance Mac hardware platform that will replace the decade-old 68000 processor family. Contributing editor Lon Poole, who ten years ago introduced *Macworld's* readers to the original Mac, shows you in "PowerPC Preview" how this powerful new processor family lays the foundation for the Macintosh computers of the next decade. (*Macworld* Communications also recently introduced a newsletter called *Power PC World* that provides the industry with coverage of the PowerPC.)

One of the most important aspects of the PowerPC chip architecture is that it is scalable, which means that it offers tremendous potential for improvements in processor speed. Although the chip's initial performance will be impressive, this is only an inkling of the performance of future versions. PowerPC will give birth to a revitalized incarnation of the Mac platform, and its speed will support exciting future technologies and applications.

documents with it). Furthermore, with this statement Apple inadvertently admitted its failure to learn the Mac's ten-year-old lesson of why a product should not be introduced without all the features required to make it a useful product.

A more propitious sphere orbited into view with the fall introduction of three new low-cost models, the Quadra 605, the Performa 475, and the LC 475. Basically the same machine with three different labels, this new low-cost family is a remarkable achievement. After three years of re-

The Macintosh Mystique

The Macintosh has always been more than just another computer. Even before

continues



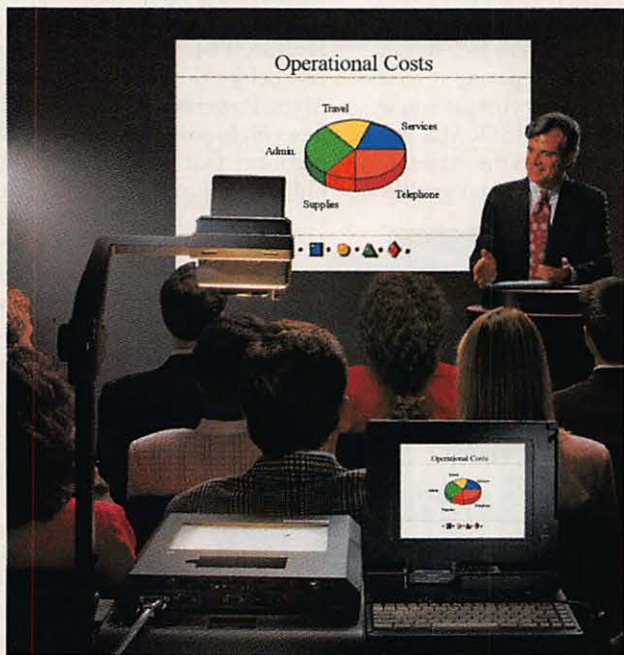
the Mac's debut, the bold "1984" Super Bowl TV commercial suggested that this was no ordinary computer but an agent of social change, striking a blow against conformity and authoritarianism. From that moment on, the Mac's proponents have championed its cause with ardent conviction.

No examination of the Mac's ten-year life would be complete without considering the expectations that have built up around it. In "Macintosh Mystique," se-

nior associate editor Charles Piller examines the extent to which Apple delivered on its promises about the Mac. He points out that some of Apple's claims have not served the Mac's best interest because they have alienated potential users who might otherwise have profited from the machine's inherent virtues. On the other hand, in *The Iconoclast*, contributing editor Steven Levy, who has covered the Mac from its very beginnings, concludes that the Mac has really changed the world.

Contributing editor David Pogue provides a more humorous assessment in *The Desktop Critic*; he looks at programs that have weathered the test of time, and those that have withered. Members of the original Mac team saw themselves as rebels and, in an incident that is now a mainstay of Mac mythology, hoisted a pirate flag above their quarters to demonstrate their rejection of the computing status quo at Apple. In his *Wise Guy* column this month, contributing editor Guy Kawasaki tells how Apple might have swept away the IBM PC and made the Macintosh the status quo.

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Circle 117 on reader service card

Giving the Mac Its Due

It's clear from any thoughtful examination that innovation has been and will be the key to the Mac's success. Apple and the Macintosh development community must continue to innovate to maintain the Mac's charter and remain true to its spirit. However, another lesson of the last ten years is that even innovative computers must be priced competitively and integrated effectively into customers' existing work environments.

In most respects, Apple appears to have learned from its mistakes. Witness the fact that there is now little or no price penalty for purchasing the extra level of quality that a Mac offers. Recent statements from Apple's leadership indicate that the company no longer views the Mac's technological advantages as a way to increase profit margins, instead seeing them as a tool for building market share. Apple still wants to offer unique advantages to Macintosh users, but without shutting them off from the rest of the world. The recent introduction of the Quadra 610, DOS Compatible version, a Mac with a 486SX processor board, is one indication of Apple's new willingness to help customers share a workplace with DOS and Windows applications.

My reading of the planetary signs is that, as Apple emerges from the shadows of last year's difficulties, the Macintosh will resurge with vitality. It's ironic that industry observers continue to speculate about the long-term survival of the Macintosh. While most computers and their makers come and go faster than failed television series, Apple and the Mac have survived and prospered. (Other than IBM and Compaq, most of today's recognized makers didn't even exist ten years ago.) After ten years everyone should acknowledge that, although the Mac has not taken over the world, it is an abiding success by any reasonable measure. From our vantage point at *Macworld*, we will continue to follow the Mac's course as it explores—and creates—new realms. **m**

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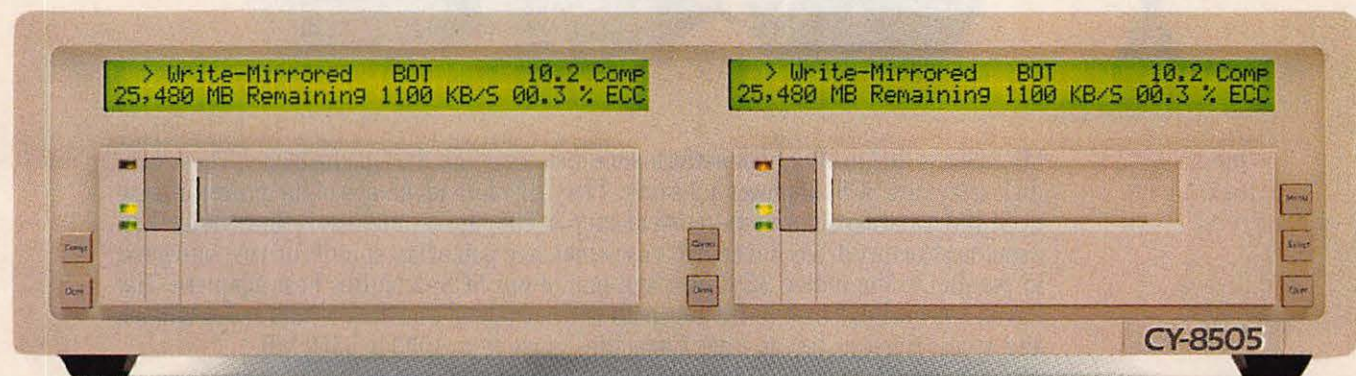
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Letters

Unhand That Keyboard

I DISAGREE WITH DR. TESSLER'S largely negative view of the Apple Adjustable Keyboard ("The Apple Adjustable Keyboard," November 1993). I'm a fairly fast touch-typist, and I find the keyboard's flaws to be relatively small and its advantages to be great, particularly in view of the fact that it costs the same as Apple's extended keyboard.

Most of the complaints that Dr. Tessler cites are exactly the kinds of things people would complain about if they used the keyboard for a two- or three-week period, which is how much he said his test audience used it. Keyboarding is a habitual activity, and the whole point is that you don't have to think about it—it's supposed to be unconscious. Any change, even a small change, in layout is uncomfortable because it disrupts your fingers' knowing where to go. I found that it took me a month to get used to even a 1/4-inch split in the keyboard.

The criticism that the palm-rest pads come off too easily is trivial. It's true that they come off easily. They also go back on easily. If you want them to stay put, fasten them with a piece of duct tape, or that gummy stuff for getting candles to stick inside the candleholder.

The alternatives that Dr. Tessler describes sound excellent, but I'm not ready for one that costs 2000 bucks and takes 200 hours of training to adapt to.

*Lorin Roche
Venice, California*

YOUR ARTICLE CONFIRMED MY experience with the keyboard eight months ago, when Apple loaned me one to test. First, it is not as good a keyboard—ignoring ergonomics—as Apple's own extended keyboard. Second, its attention to ulnar deviation (bending the wrist toward the little finger) may be marginally helpful, but it amounts to a hill of beans. CTDs (cumulative trauma disorders) result from a host of factors ranging from

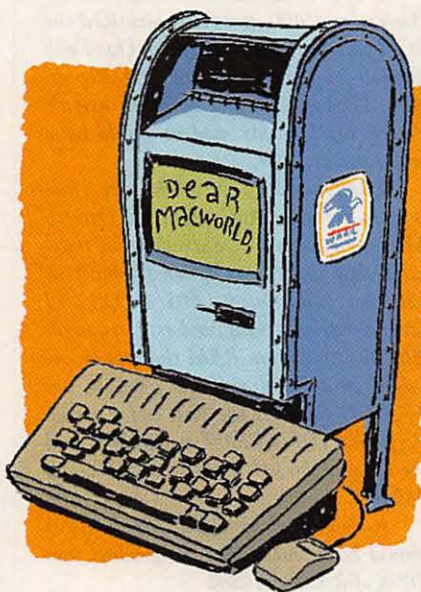


table height to chair support to keyboard force. Third, it's just too expensive. Is Apple profiting on CTD fears? Fourth, there are almost 20 third-party key-input devices, not to mention voice-driven systems, including the key-"chording" models you described. Many are more effective for reducing CTD risk factors.

To give Apple its due, your article didn't give Apple credit for the ergonomic mouse it introduced earlier this year with the ergonomic keyboard. The mouse is a model of good ergonomic design. I love it.

*Mark A. Pinsky
Yardley, Pennsylvania*

I LIKE THE WORD *ERGONOMIC*. IT'S like the word *organic* in that it's mutated into a catchall for use wherever one likes. When I read Dr. Franklin Tessler's article in the November *Macworld*, I was surprised and a little miffed at his negative approach to reviewing Apple's Adjustable (not Ergonomic) Keyboard.

I used the keyboard for the first time at the 1993 Macworld Expo and knew right then that I wanted one. I spent a week not just using it, but pretzelizing it into all the different positions and configurations I could twist it into. That's

what I thought adjustable meant—if you don't like it one way, change it! *Make* it work! Did we forget what the *B* in ADB means? It means Bus—electronic connection! Put those input devices anywhere you want them, in any order. Reassign the keys, use your imagination!

*Kelly Gates
Twin Falls, Idaho*

Faxmeister Kawasaki

REGARDING YOUR NOVEMBER FAX-etiquette column (*Wise Guy*), I thought I'd send you a few tips for good faxing that you missed.

- Watch the edges! Most fax machines don't print on a 1/4-inch or more margin on each edge. If the paper skews or is off center, you'll lose even more. I often get faxes missing notes because they were written in those margins. Also, the machine's imprinted header may obliterate the top 1/4-inch of the page.

- Don't use a pencil, and be careful of what color pen you use. When I first got my fax machine, I wrote out a test sheet with every pen I could find in my studio, and then faxed it to myself using a friend's machine. The results were illuminating.

- For tints and halftone images, use a coarse screen. Using a dithered bitmap instead of a normal halftone screen for photo images is also effective.

In the past, I have sent clients lists of faxing recommendations. It seems so silly to have to follow up a fax with a phone call to decipher the fax.

*James Needham
Canoga Park, California*

USUALLY I AGREE WITH GUY Kawasaki, but I do have a couple of bones to pick with him about fax etiquette. We use our fax machine extensively to communicate with clients and vendors, and our logo and border have become a recognized trademark. The recipients of

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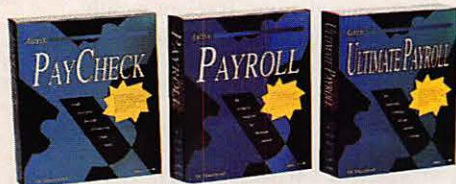
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CORRECTIONS

■ In the "Workflow Automation: One Use for AOCE" sidebar ("AOCE—Apple's Plan for Groupware," November 1993), we did not state that Shana Corporation's *Informed Manager 1.4* actually ships with Shana's *Informed Foundation 1.4*. The package lists for \$495, and also includes *Informed Designer 1.4*, *Informed Number Server 1.0*, and *Informed Revision Distributor 1.0*.

■ The "New PowerBook Duos" feature (December 1993) incorrectly identified the SCSI port on Apple's *Macintosh Duo Dock* as a DB-25 port instead of an HDI-30 port. Also, *Global Village Communication's PowerPort/Duo fax modem* should have been listed at \$399.

■ In December's "New 040 Macs" feature, in the table "Apple's Current Desktop Macintosh Lineup," we should have indicated that there is no option for built-in Ethernet on the *Quadra 605*; a PDS card (available from several vendors) is required. Also, the maximum RAM that can be installed on a *Quadra 650* is 136MB, not 132MB. Finally, the base price of the *Performa 550* is \$2000, not \$1200, and the *Quadra 660AV* runs at 25MHz, not 33MHz.

■ December's review of *Mr. File 2.0* should have stated that the product uses 200K of RAM, not 20K.

our faxes know immediately who they are from. The same is true of some faxes that we receive—we can recognize them from across the room.

There's also one thing that Guy left out. Do not under any circumstances send a cover sheet unless it contains useful information. A full sheet of paper stating that 17 more pages follow is an insult to the recipient.

Duane Oleson
Cheyenne, Wyoming

Loopy Levy? (Mostly)

MAYBE STEVEN LEVY SHOULD tune in to a more earthbound set of voices (*The Iconoclast*, November 1993). Better yet, he should go find something more productive to do with his Mac than kiddie games and multimedia gimmicks.

For us grunts in the real world, the CD-ROM is fast becoming an indispensable tool. The fact that I have gobs of clip art and stock photos on the shelf lets me service customers that I couldn't otherwise touch (the "I want it cheap and I want it now" crowd). In addition, desktop scan-

ners are OK, but in terms of cost and quality, they can't approach a Photo CD.

Eric P. Otto
Charlotte, North Carolina

CRITICIZING A CD-ROM FOR BEING slow is like criticizing a Ferrari for not being able to carry six full-size adults. A CD-ROM's reason for existence is its capacity, noncorruptibility, and low production costs. Which would you rather have: five high-density disks with an application and ancillary files that take forever to decompress and install, or one CD-ROM that transfers the entire application and files to your hard drive in a minute or so? And have you ever had to reinstall an application for some reason, only to find that one of the installation floppies had become unreadable?

George Graves
Mountain View, California

STEVEN, I ALWAYS ENJOY YOUR columns, as they are thought-provoking, even if I don't agree. I'll even keep looking for you, hidden in the middle of the magazine.

I agree with you about CD-ROMs; they are too slow. But what I find more annoying is that you can never tell what's going on. Searches on my *Centris 610's* CD-ROM do not seem to cause the stop-watch icon to appear, and the drive is so quiet that you can't hear when it is going. Often when I click on an icon in a program running from the CD-ROM, I can't tell if it is searching or if something went wrong. All that said, I'm glad I have my drive. There won't be any acceptable substitute for several years, and I'd rather have the multimedia now, slow though it is, than sit it out and wait for a better implementation.

Larry Rosenblum
via CompuServe

Reinventing the Mac

APPLE SHOULD HAVE CONSIDERED licensing its operating system ten years ago, not today (*State of the Mac*, November 1993). While Apple has played it safe by milking the Mac for all it could, no vision existed for a next-generation operating system. The rest of the computer world is poised to blow right past the old Mac OS, and Apple will be left in the dust.

A dozen years ago, Apple bet the farm on the Mac and profited tremendously. The company should make its mission to reinvent the personal computer, again.

Bruce Fraser
Alamo, California

continues

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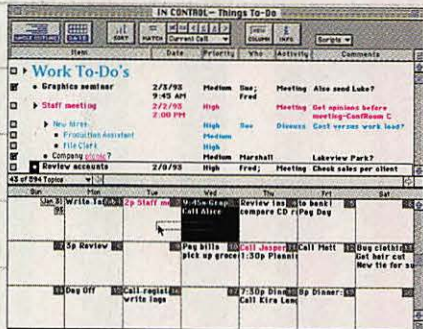


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LETTERS

NCSA Secures FTP

IN A RECENT ARTICLE ON NETWORKING products for the Macintosh ("Global Connectivity," October 1993), Joel Snyder writes that NCSA Telnet doesn't require a password for FTP access.

NCSA Telnet's built-in FTP server can either require a valid user name and password or not, depending on how you set it up. Granted, the interface for configuring this option is not straightforward, but that has been corrected in NCSA Telnet 2.6.

Jim Browne
Head Developer

NCSA Telnet for the Macintosh
Champaign, Illinois

You're right, Jim, NCSA Telnet for the Macintosh can be set up to require a password. Our real concern (mangled in the writing and editing process) was that the out-of-the-box configuration allows essentially unlimited access to local Mac files if the FTP server is activated. Users simply loading NCSA Telnet might not realize that they've left themselves open for anyone to access their hard disk.—Ed.

Rotating Scans

IN THE ARTICLE ON OCR PROGRAMS in the November 1993 issue, you state, "TypeReader cannot rotate scans, which means that you can't work with text documents printed in landscape mode unless you use an image editor" ("OCR: The Recognition You Deserve").

This is wrong. To scan landscape documents, you just click the plainly labeled, hard-to-miss landscape button on the floating window. If you have a prescanned TIFF file that is in landscape mode, you will have to use another program to rotate the image, but I've pushed many landscape documents through TypeReader without using an auxiliary program.

Edward Reid
via Internet

Edward, you said what we meant; tiny gremlins must have rearranged the words after they left our offices. No, wait. We are the tiny gremlins that rearrange words.

There's still a problem with TypeReader's approach in that if you have a large batch of prescanned documents, rotating them requires another application—and many more steps.—Ed.

Checking Up on Grammar

DAVID POGUE'S PIECE ON GRAMMAR checkers is still correct, even after all these years (*The Desktop Critic*, November 1993). In most respects the job

The 1993 index to *Macworld* articles is available by mail. To receive a copy, send a self-addressed, legal-size envelope with 58 cents postage (two 29-cent stamps) to Index, *Macworld*, 501 Second St., San Francisco, CA 94107. The 1993 index is also available in the *Macworld* forum on America Online, as well as on the *Macworld Resources* CD-ROM, which will be distributed at the San Francisco *Macworld* Expo.

seems to be too complicated and subtle for rule-based software to accomplish accurately and usefully. Used another way, though, some of these checkers can be quite helpful. Correct Grammar and Grammatik 5 for Macintosh, and maybe some other programs Pogue mentioned, can calculate readability scores, including indicators of the grade level at which you are writing, as well as the average length of sentences and words, percentage of sentences in passive voice, and other such general measurements.

I often run the Microsoft Word version of Correct Grammar with all the rules turned off when I think I'm about ready to go to press. Turning off the rules avoids all the false alarms and obtuse and arcane warnings the rule-based checker usually throws up, but the general scores let me know when I am writing sentences that are too long, copy that requires a 14th-grade education to read comfortably, words that may confuse a general-audience reader, or too many passive-voice sentences. Then, using the scores I get, I go back to the original copy and shorten my sentences, remove passive voice, and put in a two-cent instead of a ten-cent word here and there. While the programs often get it wrong on a sentence-by-sentence run with rules turned on, as Pogue described, they give useful feedback when used as I describe. It really helps get me to that seventh-grade level most people find easy to read—but it lets me do it instead of schoolmarm me to death.

Jim Upchurch
Montgomery, Alabama

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Poor Claris. Once again, Canvas™ is running circles around MacDraw® Pro. In fact, they are still trying to catch up to Canvas 3 while we've added dozens of new features and enhancements to create Canvas 3.5. Like 3-D extrusions of text and graphics, enveloping of text and graphics, smart lines, fine kerning, fractals, automatic concentric circles and spirals, and a tool loader that allows you to add tools as you work. There's even a versatile pressure-sensitive freehand Bézier pen tool. And Canvas 3.5 has really outdone itself with new improvements including object blends, binding of text to shapes and curves, Beziér text conversions, and macro windows. Which is just the beginning, because Canvas also includes all the great features of 3.0 like custom parallel lines and curves, our unique SmartMouse™, and more. Comparing Canvas to the competition is like comparing a superbike to a tricycle. And only Canvas is self-upgrading, allowing you to add new tools, effects and file translators at will. Last but not least, while MacDraw Pro is idling somewhere back in the Dark Ages, Canvas features seamless file sharing with its recently released Windows version. Add it all up, and it's Canvas. For the gives you the ride

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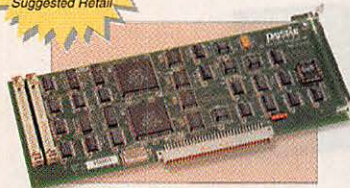
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MacBulletin

System 7 for PowerPC Goes Beta

At Comdex in mid-November, Apple announced that it had begun final testing of System 7 for PowerPC, perhaps its most crucial product ever. The company said it expects to ship the first PowerPC Macs with the new operating system on schedule, sometime in the first half of 1994. (See "Developers Back PowerPC," *News*, in this issue.)

New AppleScript, New HyperCard

Apple recently announced new versions of AppleScript and HyperCard that work together to create multiple-application environments, among other functions. The \$189 AppleScript Scriptor's Kit will help automate tasks that require several applications by linking functions between standard application programs modified to work with AppleScript. Available through Apple dealers and APDA, the product includes AppleScript 1.1, an enhanced script editor; and Frontmost Interface Processor, a front end for launching scripts. HyperCard 2.2 now supports up to 256 colors and is scriptable, so it can be used as an environment for launching AppleScript-aware apps. It comes with Addmotion II for adding animations. HyperCard 2.2 will list for \$249; its introductory street price is around \$100. Upgrades from HyperCard 2.0 and 2.1 will be \$89. Apple expected to ship AppleScript Scriptor's Kit and HyperCard 2.2 by the end of 1993.

High-End Accelerator from RasterOps

At press time, RasterOps released more details of its 24-bit image processing accelerator called the RasterOps Horizon 24 Graphics Subsystem (see the *Graphics* news section in this issue). Due in mid-December, the Horizon 24 will work with any existing NuBus Mac that can hold a full-size card. A future 7-inch version will work with the first PowerPC Macs. The initial version will list for \$4999 with 4MB of RAM, \$5799 with 16MB, and \$12,499 with 64MB. A 256MB version is due in spring

at approximately \$25,000. RasterOps, 408/562-4200.

DeBabelizer Lite

Equilibrium's DeBabelizer Lite is a streamlined, easier-to-use version of its DeBabelizer graphics file-translation and batch processing utility. Lite doesn't let you customize translation settings or translate animation files, but it does automatically handle basic tasks such as mapping color palettes, resizing images, and applying preconfigured filters. It recognizes over 55 graphics and animation formats, including DOS, Windows, SGI, and Amiga, as well as Photoshop plug-ins. Due by the end of 1993, Lite's street price should be under \$100. Equilibrium, 415/332-4343.

Apple Licenses Radius Accelerator

Apple will offer a 24-bit graphics accelerator based on Radius's PrecisionColor Pro 24x board, according to Radius. Apple confirmed the agreement, but at press time the company declined to give details of its version of the board or say when it will be available or at what price. Capable of supporting two-page monitors, the PrecisionColor Pro 24x lists for \$2495 from Radius.

RAM Doubler

Connectix has introduced a \$99 system extension called RAM Doubler, which compresses part of the contents of 040 Macs' system RAM, effectively increasing the RAM's capacity by nearly a factor of two. Slated to ship in January. Connectix, 415/571-5100.

Apple Tests Its Home Shopping System

Apple, EDS, and Redgate Communications Corporation have launched En Passant, a pilot version of a CD-ROM-based, interactive home-shopping service that will include 21 catalogs from well-known companies. Apple and its partners are sending the CD-ROM mostly to home users of registered Mac-compatible CD-ROM drives. The pilot program will be evaluated after it ends on January 31, 1994. **m**

News

EDITED BY TOM MORAN

IN THIS ISSUE

p. 35 Support for PowerPC p. 36 Tax Software p. 36 Low-Cost 20-inch Monitor

p. 37 Portable Floptical Drive p. 37 Video E-Mail

p. 37 17-inch Radius Monitor p. 38 Color Thermal-Fusion Printer p. 38 40MHz 040 Accelerator

Apple Ships Its First Mac with DOS

Saying that its basic Macintosh platform strategy has not changed, Apple recently announced the company's first computer to come with DOS installed. The Quadra 610, DOS Compatible version is a vanilla Quadra 610 with an Apple-designed 486SX processor card bundled in and DOS 6.2 on the hard drive along with System 7. Apple sees this machine selling to home offices where there are several users; to schools; and to individual professionals and small businesses. One scenario is a user who wants the Mac's ease of learning and use, but needs to run one critical DOS application that's not available on the Mac. Apple doesn't expect this system to appeal to the corporate market because the current version has no network connection on the DOS card. Orange Micro sells a series of similar DOS add-in cards that offer a variety of networking options, but these are more expensive than Apple's solution, which has a preliminary price of "less than \$500 more than a Quadra 610," according to Apple. Apple will sell its DOS Compatibility Card separately



The Quadra 610, DOS Compatible version runs DOS 6.2 and System 7 concurrently. The system can support two monitors, one for DOS. With one monitor, users can toggle between the environments.

as an upgrade for existing Quadra 610s and Centris 610s; its preliminary price is "around \$500."

The card contains a VGA display chip set, a single 72-pin SIMM connector that supports up to 32MB of RAM, and a 25MHz 486SX chip that can run concurrently with the

Mac's processor. Designed to support a second monitor, the card lets you attach one monitor that displays the Mac interface and another with DOS or Windows running. In that configuration, the cursor moves between the two screens in the usual way. If you only have space or a budget for

one monitor, you can toggle between DOS or Windows and the Mac by hitting a hot key. You can set up the system so that the DOS add-in card and the Mac share the RAM on the Mac motherboard, but if you add RAM to the single SIMM connector, the DOS module can no longer use the

motherboard RAM.

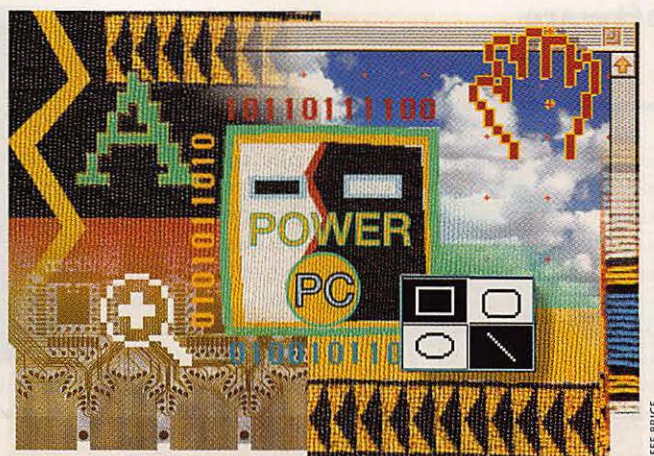
The two operating systems share the same I/O and the hard drive. Apple has set up some clever ways of translating file names, and it has also supported cut-and-paste between the environments (so far, only for text and PICT files). Apple said it will include software that will convert Epson printer-control characters to QuickDraw, so you can use a standard Mac printer to print your DOS files. The company said that converting the widespread HP PCL printer-control language to QuickDraw is more difficult and that the capability may be added later. The Mac's built-in SuperDrive (Apple's standard floppy disk drive for some time now) can read and write standard DOS disks and will appear to DOS as the A: drive. Apple said it does not plan to include Microsoft Windows anytime soon, but that the card can run it without problems after the user installs it.

The card comes with a PDS adapter designed especially for it and a split cable to support the two monitors. It also has a built-in game port, but no support for SoundBlaster as yet. Both the DOS Compatibility Card and the Quadra 610, DOS Compatible version should be available in the first half of 1994. Apple, 408/996-1010.—T.M.

Developers Back PowerPC

APPLICATIONS GO NATIVE

Even the most powerful hardware platform is useless without application software. The thought of Apple's upcoming PowerPC D-day could easily bring back bad memories of the Mac's nail-biting first year sans software—except for two things. First, the PowerPC Macs will run existing Mac applications in emulation mode; and second, third-party developers



are enthusiastically working on native PowerPC applications that will be much faster on the new machines than existing applications, because the former are designed for the new architecture.

Major Mac software developers are responding to the PowerPC's seductive songs of speed and power, promising that their native PowerPC applications will appear either at the same time as Apple's initial rollout (expected sometime in the first half of 1994) or within 4 to 12 weeks afterward. This fall at the Seybold San Francisco exposition, several developers showed mostly stable beta versions of popular Mac applications ported to the new platform. Adobe demonstrated Photoshop for the PowerPC, with the same feature set as its Mac and Windows siblings. Aldus proved just how powerful the PowerPC is by demonstrating a native version of FreeHand that reacted in something approaching real time. Fractal Design demonstrated the next generation of Painter (code-named Painter/X3), showing real-time application of complex, liquid brush effects. Specular showed off a PowerPC version of Infini-D scheduled to ship just as Apple is rolling out the new hardware—according to the company, its new image-composition program, Collage, won't be far behind. All of these early applications will depend heavily on the two things the PowerPC chip and system software excel at: QuickDraw

calls and floating-point math calculations.

Other developers haven't actually shown applications yet but have publicly committed to supporting PowerPC with specific products. Claris, being a wholly owned Apple subsidiary, can be expected to vote early and often with its software development dollars. Its stated goal is to have ClarisWorks be the first native PowerPC application to ship. It is also currently examining the rest of its product line, especially MacDraw Pro and FileMaker Pro, with an eye toward expanding its PowerPC offerings.

With Canvas 4, Deneba is taking an approach shared by companies such as Microsoft. They're developing platform-independent core code, and then building Mac, Windows, and PowerPC front ends onto the basic instruction set. Speaking of Microsoft, look for PowerPC versions of Excel 5, Word 6, and Works 4.0 (even though Works isn't part of the Microsoft core code program) in the first half of 1994. PowerPoint should follow soon after to complete the Microsoft Office suite.

HSC Software has promised native PowerPC versions of Kai's Power Tools and Live Picture. Wolfram's Mathematica will also appear in PowerPC form in 1994, according to the company.

Desktop publishing rescued the Mac from an early grave, and PowerPC early adopters can count on native *continues*

DayStar Cuts Accelerator Prices

Claiming economies of scale, DayStar has announced it is dropping the list prices of most of its accelerator boards for Macs. The cuts range from \$70 on a 50MHz Universal Power-Cache without FPU (now \$679), to \$300 on an Image 040 graphics accelerator with 40MHz 040 and twin DSPs (now \$2399). (See *News, Macworld*, November 1993.) 401/967-2077.

SyQuest Ups Warranty to Five Years . . .

SyQuest Technology recently increased the warranty on its 44MB and 88MB removable cartridges for its 5¼-inch SyQuest drives to five years. The new warranty policy covers all cartridges shipped after December 31, 1992. The company's warranty on the 5¼-inch drives continues at two years. 510/226-4000.

. . . And Radius Goes for Life

If you own a Radius add-in board of any kind, it's now guaranteed for life if you're the original owner, you have your receipt, and you registered the product within 30 days. Radius says it will replace any defective board within 24 hours at no cost. 408/424-1010.

Claris CAD Discontinued

Claris has confirmed that it will discontinue Claris CAD and will continue to offer technical support for the product only through September 30, 1994. Claris and Ashlar jointly announced that Ashlar will offer Claris CAD owners a \$399 upgrade to Ashlar Vellum 2D (normally \$2495) and a \$499 upgrade to Ashlar Vellum 3D (normally \$2995). DesignCAD is separately offering a \$99 upgrade to DesignCAD 2D/3D Macintosh (normally \$299). Ashlar, 408/746-3900; DesignCAD, 918/825-4848.

Native PowerPC Software

Company	Product	Availability*
ACI US	4D Server	3-6 months
	4th Dimension	3-6 months
	Object Master	concurrent
Adobe Systems	Adobe Photoshop	2-6 months
	Adobe Dimensions	2-6 months
	Adobe Illustrator	2-6 months
	Adobe Premiere	2-6 months
Aldus Corporation	Aldus Persuasion	3-6 months
	Aldus FreeHand	3-6 months
	Aldus PageMaker	3-6 months
Aladdin Systems	StuffIt SpaceSaver	1st half 1994
	StuffIt Deluxe	concurrent
	StuffIt Expander	1st half 1994
Canto Software	Cirrus 2.0	concurrent
	Cumulus 2.0	concurrent
Central Point Software	AntiVirus for Macintosh	summer 1994
	MacTools	summer 1994
Claris Corporation	ClarisWorks 2.1	concurrent
Dantz Development Corporation	Retrospect	concurrent
	Retrospect Remote	concurrent
Dayna Communications	Pro Files	concurrent
Deneba Software	Canvas 4	60-90 days
Fractal Design	Painter 2.0	concurrent
	Painter/X2	concurrent
Frame Technology	FrameMaker	4 weeks
Great Plains Software	Dynamics C/S+	Q2 1994
	Dynamics Release Two	Q2 1994
HSC Software	Kai's Power Tools	concurrent
	Live Picture	concurrent
Insignia Solutions	SoftWindows for the Macintosh with PowerPC	concurrent
Microsoft Corporation	Excel	1st half 1994
	Word	1st half 1994
	Works	1st half 1994
Now Software	Now Compress	NAPT
	Now Contact	NAPT
	Now Up-to-Date	NAPT
	Now Utilities	NAPT
Pixar	Showplace	concurrent
	Pixar Typestry	concurrent
Ray Dream	Ray Dream Designer 3.0	concurrent
Specular International	Collage	60 days
	Infini-D	concurrent
	Logomotion	60 days
Strata	Strata Studio Pro	concurrent
	StrataVision	1994
VideoFusion	VideoFusion	NAPT
Wolfram Research	Mathematica	30 days
WordPerfect	WordPerfect 3.0	concurrent

NAPT = Not available at press time.

*After Apple's Introduction. May depend on last-minute changes to PowerPC architecture.

versions of Aldus PageMaker and Frame Technology's FrameMaker 4.0 to be available in relatively short order. QuarkXPress, on the other hand, will not be in the DTP lineup. At press time, Quark was hedging, quoting engineering costs and doubtful

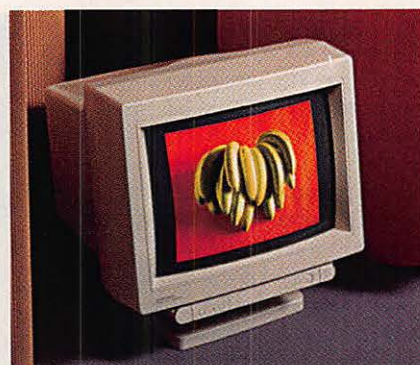
customer demand as reasons to hold off on development.

Perhaps one of the most important native PowerPC software products on the way is Insignia Solutions' SoftWindows for the Macintosh with PowerPC. The product, developed in partnership with

Microsoft, is based on the Windows source code and runs Windows and MS-DOS applications at 486 PC speeds, while supporting PC networks such as Novell NetWare and Microsoft LAN Manager, according to Insignia. Informal observations of beta versions seem to bear out this claim, giving Apple a powerful weapon in the fight to attract Windows and DOS users to the new platform.

As for Mac developers creating native PowerPC versions of their applications, the question is no longer if they will, but when. The roster is growing rapidly; many developers using Apple's porting tools report usable first ports from clean Mac code in a matter of days. Admittedly, it's a big step from ported code to final product, but even so, Apple has assembled a formidable cadre of software support. If all goes as planned—and so far it seems to be—the PowerPC juggernaut will be hard to stop.

—CAMERON CROTTY



The 20-inch Mitsubishi Diamond Scan 20 Plus offers resolutions up to 1280 by 1024.

the coating reduces glare and magnetic static. The monitor meets the Swedish MPR II guidelines for ELF emissions. Mitsubishi, 714/220-2500.

—JOANNA PEARLSTEIN

In This Vale of Taxes

THIS YEAR'S MACINTAX

It's that time of year again—time to start thinking about your taxes. This year ChipSoft has two new tax-planning products, MacInTax Tax Planner and MacInTax Tax Savings Guide. The company has also upgraded MacInTax itself, and now offers a total of 20 separate state-tax editions.

MacInTax Tax Planner is a \$29.95 tax-forecasting and -analysis program. It uses ChipSoft's Easy Step interview to guide users through tax planning, and shows how actions such as buying or selling a home will affect future tax liability. The MacInTax Tax Savings Guide, \$19.95, is an interactive tax-strategy guide with more than 250 tips.

In upgrading MacInTax, ChipSoft has stressed ease-of-use. The interview feature has been revised, and a new deduction finder helps you spot deductions you might have missed. Printing should be faster and more reliable with the added TrueType fonts, and improved memory management speeds up scrolling. MacInTax will have a list price of \$69.95, and state ver-

Little Big Monitor

LOW-COST 20-INCH DISPLAY

Mitsubishi is shipping the Diamond Scan 20 Plus, a high-resolution 20-inch monitor. Mitsubishi is positioning the \$2699 Diamond Scan 20 Plus as a lower-cost alternative to its Diamond Pro 20 and Diamond Pro 21FS.

The display offers a maximum resolution of 1280 by 1024 pixels at a refresh rate of 74Hz. It supports resolutions as low as 640 by 480. Having an antiglare coating on the CRT glass instead of a bonded panel reduces the cost by about \$300. Mitsubishi says

sions will cost \$29.95 each. Four different products for taxes may seem excessive, but ChipSoft offers a coupon-in-the-box promotion, so buying one product gets you a coupon for money off another. ChipSoft, 619/453-8722.—WENDY SHARP

First 17-inch Monitor from Radius

FILLING OUT THE LINE

Acknowledging the popularity of 16- and 17-inch color monitors, Radius has introduced the PrecisionColor Display 17. The 17-inch monitor, the first such from Radius, is intended to broaden the company's product line in smaller monitors. The Trinitron-based, microprocessor-controlled PrecisionColor Display 17 will be priced above the Radius PrecisionColor Pivot Monitor, the 15-inch monitor that turns from portrait mode (vertical) to landscape mode (horizontal). The list price was not set at press time, in part because Radius expects the display industry to undergo price cuts late in 1993 and will price the monitor then. Shipments should begin in January. Radius, 408/434-1010.—T.M.

Floptical for PowerBooks

IOMEGA'S BATTERY-POWERED DRIVE

PowerBook users on the run have yet another storage option available to them: Iomega's battery-powered floptical drive. Weighing slightly over 2 pounds, the \$399 PowerBook Floptical is about the size of a paperback book. It stores up to 21MB of data on a 3.5-inch disk, has a

TREND

iSpy Video Mail

ME IN MY MEMO

First there was AppleTalk, then there was E-mail. First there was PowerTalk, and now there's video mail. Axion is offering the iSpy Bundle, a \$799 combination of video camera, board, and AOCE-savvy software that lets you view your boss's next memo. The iSpy color video camera contains a unidirectional microphone for sound capture, mounts on your monitor or on an optional stand, and plugs into any digitizing card using standard NTSC or PAL inputs. The 7-inch iMovie video-digitizing board fits into any NuBus Mac and grabs motion video at up to 320 by 240 pixels in 16-bit color at 24 frames per second, depending on the speed of the host Mac. The

board also simultaneously captures 16-bit stereo audio at up to 44.1KHz.

The software guts are in the iMail video-mail package that works with the AOCE-to-video mailbox; users can record, edit,



The iSpy Video Bundle includes a desktop video camera and video E-mail software.

play back, send, and receive QuickTime movies over a network. The software, board, and camera can be purchased separately and work independently with other components. Axion, 408/522-1900.

—CAMERON CROTTY

data-transfer rate of 1.6 Mbts per second, and includes a built-in HDI-30 SCSI cable.

Like other floptical drives, the PowerBook Floptical uses a combination of magnetic and optical technology, reads and writes to 21MB floptical and 1.44MB standard floppy disks, and is up to three times faster than normal floppy drives.



The battery-powered PowerBook Floptical stores 21MB and lists for \$399.

The drive runs on a spare battery designed for any PowerBook 140 through 180, or on most PowerBook AC adapters. Additionally, Iomega's Power Pass Through cable (included) allows non-color PowerBooks to share the same AC adapter with the PowerBook Floptical drive. Color PowerBooks and Duos require an additional PowerBook AC adapter; the PowerBook Duo AC adapter's voltage is incompatible with the Iomega product.

Iomega is selling the PowerBook Floptical only through the *Apple Catalog*. Iomega, 801/778-1000; *Apple Catalog*, 800/795-1000.—JOANNA PEARLSTEIN

Low-Cost Hammer Drives

FWB has introduced the low-cost Hammer PE series of Mac hard drives and removable-cartridge drives. The hard drives range from 170MB to 545MB, with list prices from \$529 to \$1139. An internal 128MB removable-optical drive lists for \$1269, or \$110 more for an external version. FWB will offer a 44MB SyQuest drive for \$559, an 88MB SyQuest for \$745, and a 105MB SyQuest for \$899. All are shipping. 415/474-8055.

Speeding Up LCs and LC II's

Harris International is bringing out the PerformerPro LC, a 32MHz 68030 accelerator board for the Macintosh LC and LC II. The \$349 accelerator has a socket for a \$100 FPU. Available now, it improves system performance by up to 300 percent and meets Apple's power budget for LC and LC II add-in boards. 612/482-0570.

Focus Enters Display Market

Focus Enhancements is shipping a series of color, monochrome, and gray-scale monitors, and a series of display boards. The color monitors range from 14 inches (\$499.99) to 21 inches (\$2699). The monochrome and gray-scale monitors cost from \$379.99 to \$749.99. The color display boards start at \$479.99 and top out at \$1499. Monochrome and gray-scale display boards run from \$299.99 to \$499.99. Focus also unveiled the L TV series of TV output boards for \$899.99 to \$1799. 617/938-8088.

Mac-to-DOS for Windows

This \$99.95 software lets Windows users with the appropriate hardware read and write to Mac 1.44MB floppies or to SyQuest, Iomega, and removable optical cartridges. It also lets Windows machines format Mac 1.44MB floppy disks. Now shipping from Peripheral Land Inc. (PLI), 510/657-2211.

Radius Rocket: The Next Stage

HIGH-PERFORMANCE
MULTIPROCESSOR

With PowerPC Macs looming on the horizon, Radius is aiming for the heights with a faster, 40MHz 68040-based version of its Radius Rocket multiprocessor add-in board. Designed for existing Macs that have a full-size NuBus slot, the new Rocket, code-named T2, will function only as a multiprocessor board under Radius's RocketShare software. The previous version could act as a multiprocessor subsystem (also with RocketShare) or as a system accelerator when running under the company's RocketWare software. The T2 board will now ship with RocketShare includ-

ed and also with an installed SCSI-2 daughterboard that is an option for the original Rocket. The daughterboard will be included because many of the board's multiprocessor applications require fast and frequent access to SCSI peripherals, and because the board will not be used purely as an internal one-system accelerator. RocketShare gives a user network-access to multiple Rocket boards resident in multiple Macs, so a task such as manipulating a huge graphics file can be parceled out to those processors. A user can also run multiple applications at once, using multiple Rockets or T2s. Another new feature is NuBus 90 bus-master support, for faster data transfers (up to 50MB per second) to other NuBus 90-capable boards. Macs that support NuBus 90 boards include the Centris and Quadra lines. Radius also says that its previ-

THE AMCoEX INDEX OF USED MAC PRICES

Machine/RAM/Hard Drive	Average Sale Price	Monthly Change
PowerBook 100/4MB/40MB	\$725	-\$75
PowerBook 140/4MB/40MB	\$1000	-\$100
PowerBook 180/4MB/80MB	\$1800	-\$175
PowerBook Duo 230/4MB/80MB	\$1250	-\$225
Mac Classic/2MB/40MB	\$500	-\$50
Mac SE/30/2MB/40MB	\$750	-\$25
Mac LC II/4MB/40MB	\$600	-\$125
Mac IIsi/3MB/40MB	\$650	-\$150
Mac IIfx/4MB/80MB	\$1100	-\$100
Mac IIfx/4MB/80MB	\$1300	-\$200
Centris 650/8MB/230MB	\$1700	-\$150
Quadra 900/8MB/160MB	\$2850	-\$100

Index provided by the American Computer Exchange of Atlanta, Georgia (800/786-0717). It reflects sales during week of November 20. Configurations include keyboard and exclude monitor and display board for noncompact models.

ously announced optional dual-DSP daughterboard for Rockets and T2s has been delayed.

The company has improved RocketShare by making it possible for a Macintosh user with no Rocket to access the Rockets in remote Macs over a network.

Radius expects to announce and ship the T2 in early January. Radius, 408/434-1010.—T.M.

The thermal-fusion process permanently bonds toner (from a ribbon cartridge) onto media including ordinary printer paper, card stock, laminated peel-off labels, and transparencies.

The SJ-144MC features three paper-handling methods: a 30-sheet automatic sheet feeder, a straight-through manual paper path for inflexible media such as card stock, and a manual front-feed path for individual sheets of plain paper. The printer comes with 35 TrueType fonts on a floppy disk. It can print inverse images that can be used for iron-on transfers or bumper stickers. The SJ-144MC requires System 6.0 or later. The company said it plans to begin shipments in January at a suggested list price of \$599. Star Micronics, 212/986-6770.—T.M.

BUGS & TURKEYS



QuarkXPress 3.2 users have reported problems using fonts whose ID numbers fall outside standard limits. The fonts don't appear in QuarkXPress menus and are therefore unusable. Quark says that QuarkXPress 3.2 Patcher—available on AppleLink, CompuServe, and America Online—fixes the problem.



QuarkXPress 3.2 and Symantec's Norton Utilities Directory Assistance II are incompatible. The conflict is with Norton and the EfiColor Processor in QuarkXPress 3.2. Symantec says to remove the EfiColor Processor from the QuarkXPress folder. Quark says to remove Symantec's Directory Assistance. Symantec and Electronics For Imaging are working on a fix.



Do you need to archive your faxes? For now, don't look to Global Village's fax software: if you move your faxes out of the Fax Spool folder in your System Folder, you can't open them. Global Village says the problem will be fixed in a future version.



People who try to install Apple's version of the LaserWriter 8.0 driver after October 1 are greeted with the message "Decompressor Atom has Expired," and a system crash. The workaround is to reset your system clock to before October 1 or install version 8.1.1, which is available on CompuServe or America Online.

Macworld will send you a Bug Report T-shirt if you are the first to inform us of a serious, reproducible bug that we report in this column, or a Turkey Shoot T-Shirt if we shoot your turkey in this space. See *How to Contact Macworld*.

Versatile Color Printer

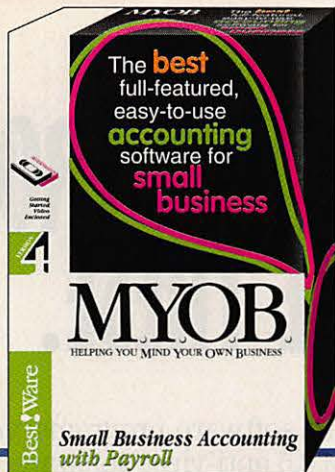
STAR MICRONICS' DEBUT
FOR THE MAC

Longtime printer manufacturer Star Micronics America has introduced its first-ever product for the Macintosh, a desktop thermal-fusion printer that can generate color or black-and-white output. Based on the company's current SJ-144 model for PC compatibles and intended for small-office or home use, the SJ-144-MC produces 382 characters per second at 360 dpi.



The \$599 SJ-144MC Color Printer can produce CMYK color images or black text.

TOM GIBSON



M.Y.O.B. SMALL BUSINESS ACCOUNTING

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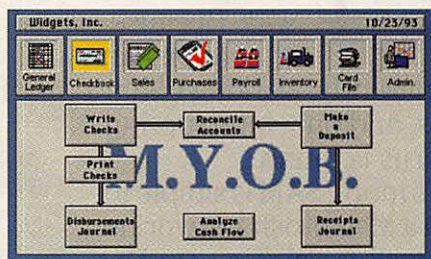
New!
Version 4.0

A LOT OF ACCTG PKGAGES AR SHOKINGLY INCMPLTE

In fact, we're constantly amazed at what the other guys leave out. After all, what good is an inventory system that doesn't print packing slips or offer volume discounts? What good is a payroll system that doesn't automatically provide the federal, state and local tax rates?

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No accounting experience is necessary! Pre-formatted templates for over 30 types of businesses let you get started in minutes. Generating an invoice is as easy as filling in the blanks. So is writing checks, recording payments, and tracking who owes you money.



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Packing Slips	✓
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Easy, Real-Time Adjustments	✓
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Unlimited Payroll Categories	✓
Automatic Payroll Tax Calculation	✓
Reports Available	85
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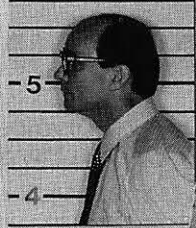
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Circle 194 on reader service card


WE OFFER THE MOST PROTECTION FROM RUTHLESS CRIMINALS LIKE THESE.

CASE NO: 35219




NAME	Randy Hibbitts		
AGE	39	WEIGHT	2
HEIGHT	5'7"	HAIR	Blk
EYES	Hazel	SEX	M

CASE NO: 63210



ARRESTING OFFICER	Danny Kim		
PLACE OF ARREST	Fairmont Drive		
CRIME	Computer Tampering		
counts/started ZUC virus			

CASE NO: 38271



NAME	Doug Nester		
AGE	32	WEIGHT	164
HEIGHT	5'3"	HAIR	Blonde
EYES	Brown	SEX	M
ARRESTING OFFICER	Sgt. Hans Logie		
PLACE OF ARREST	Union Street		
CRIME	Computer Tampering		
3 counts/started nVIR			

and various software programs, you need SAM 3.5 anti-virus software.

You see, SAM will constantly monitor for 14 suspicious viral activities. Which is more than any other anti-virus program on the market. And it's the only

program that will scan compressed files in System 6.0 and 7.0.

So basically, if your Mac has a virus, SAM will detect it, get rid of it and repair the file. And if your Mac is virus-free, SAM will help to make sure it stays that way. Because it monitors your

Mac transparently, working behind the scenes, and only interrupting when a virus is found.

What's more, SAM is simple to install on a Macintosh networking* system, as well as a single-user Mac.

All you need to do is load the program disk, double-click on the Installer Icon and let SAM handle the rest.

For the most anti-viral protection, pick up SAM 3.5 at your local retailer. It's the most popular anti-virus program in the world, and will keep you from ever having to deal with this ugly crime. Or these ugly criminals.

SAMTM
Symantec AntiVirus for Macintosh
SYMANTEC.

Junkbond dealers? Drug lords? Savings and Loan presidents?

Nope, they're computer hackers. And judging by their physical appearance, you wouldn't think you'd need any protection from them. But you do. Or should we say, your computer does.

And to keep these criminally minded people from infecting your files, floppies



SAM is a registered trademark of Symantec Corporation. All other names are trademarks of their respective holders. In Canada, call 1-800-667-8661. Everywhere else, call 408-252-3570. *Available for volume purchasers, and with the SAM 10-pack version. Call 1-800-554-4403. Select option #1 and request document #621. To upgrade to SAM 3.5 for \$24, call 1-800-343-4714 ext. AR59. Offer price in U.S. dollars. Valid in U.S. and Canada only. ©1993 Symantec Corporation. All rights reserved.

Circle 180 on reader service card

New Products

THE LATEST MACINTOSH RELEASES

by Cameron Crotty

THIS SECTION COVERS MACINTOSH PRODUCTS FORMALLY ANNOUNCED BUT NOT YET EVALUATED BY MACWORLD. UNLESS OTHERWISE STATED, THE MINIMUM REQUIREMENTS FOR OPERATION ARE A MAC PLUS, WITH 1MB OF RAM, RUNNING SYSTEM 6. ALL INFORMATION AND PERFORMANCE CLAIMS ARE SUPPLIED BY THE PRODUCT VENDOR AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY MACWORLD. ALL PRICES ARE SUGGESTED RETAIL. PLEASE CALL VENDORS FOR INFORMATION ON AVAILABILITY.

HARDWARE

AP PhotoLynx Pro

Transmitting photos from the war-torn hills of, well, anywhere in the world? This portable PowerBook docking station contains a Nikon Coolscan slide scanner and ships with custom photo previewing and transmission software. The whole package (with PowerBook) weighs about 15 pounds, but the PowerBook is sold separately. An internal battery is also available. \$6750. Associated Press, 212/621-7833, 800/453-8883; no fax.



AP PhotoLynx Pro

CV Link

What's on TV tonight? Your Macintosh screen, with the aid of this digital scan converter. The product is an external box that converts standard Mac 640-by-480 RGB output into an NTSC composite, S-Video-quality signal. No software is required, and the CV Link ships with all necessary cables and an AC adapter. Requires Mac LC. \$599. Display Tech, 510/676-9362, 800/578-8546; fax 510/676-9335.

EnviroMac

Give your Macintosh power over the world that surrounds it with this environmental-control package. The hardware end is an RS-232 peripheral with 16 analog and 4 digital inputs, plus an X-10 compatible controller and 6 or 12 hard-wired voltage outputs. The ADControl software shows data by list, graph, or custom display. Users can define sensor types, calibration equations, sampling frequencies, and up to 40 conditional rules per device. Measurements can be saved to disk at specified intervals as ASCII text files. A light sensor and a temperature sensor are also included. \$899. Remote Measurement Systems, 206/883-7000; fax 206/328-1787.

G-Vox

If you've ever wanted to blaze on guitar like Steve Vai or Joe Satriani, this hardware-software combination will let your Macintosh help you out. The hardware end is a lightweight pickup that you attach to your electric or acoustic guitar with suction cups. The pickup translates the string vibrations into digital signals that your Mac understands. The software interprets these signals and figures out which note you played. Several packages are available, including libraries of licks and technique exercises from the likes of Steve Morse, Carl Verheyen, and Greg Davis; and Tour, a game that increases fretting speed and accuracy. G-Vox \$399; Tour \$59. Lyrrus, 215/922-0880, 800/789-4869; fax 215/922-7230.

Intelligent Data Equipment Adaptor

It never fails that you're on the road with your cellular phone, and you need to send a fax from your PowerBook, or log on to Internet. This adaptor plugs into AT&T, Motorola, NEC, OKI, and other cellular phones, and provides an RJ-11 jack into which you can plug your modem phone cord. As far as your modem is concerned, it's talking to a



Intelligent Data Equipment Adaptor

standard phone line. The product requires a 9-volt battery and ships with a phone-specific adapter cable. \$249.95. ORA Electronics, 818/772-2700; fax 818/718-8626.

MegaHaus Drive

Sure, you don't have the biggest Mac or the whizbangiest processor, but that doesn't mean you can't have massive amounts of storage at your fingertips. This internal 3 1/2-inch hard drive is designed specifically for the LC family of Macs and offers 1GB of storage space, with average access times around 9ms and a Fast SCSI-2 interface. The drive ships with mounting hardware, and an external version is also available. Internal \$1149; external \$1199. MegaHaus, 713/333-1925, 800/786-1173; fax 713/333-3024.

Mirror Coolscan ZFP

Keep your scans cool with this 2700-dpi SCSI slide scanner, which uses Nikon's LED light-source technology to deliver consistent 24-bit scans at low power consumption with no warm-up time—an average low-resolution scan takes about two and a half minutes. The scan-



Mirror Coolscan ZFP

ner can handle mounted or unmounted slides—unmounted slides can be loaded into the six-frame filmstrip holder. The product ships with a Photoshop-compatible plug-in to facilitate scanning. Users can preview and crop the scan and adjust the exposure levels, output resolution, and RGB gamma curves. \$1999. Mirror Technologies, 612/633-4450, 800/654-5294; fax 612/633-3136.

Ovation 814

Big presentations demand big firepower. This 10.4-inch active-area color LCD panel is designed for situations where the panel must be placed more than 10 feet from the projection screen. The active matrix display can reproduce over 2 million colors, and it comes with a remote control you can program to move your presentation forward or back, or to freeze an image on the screen. An adapter that decodes NTSC, PAL,

SECAM, and S-VHS video is available as an option. \$6395; video adapter \$695. Proxima Corp., 619/457-5500, 800/447-7694; fax 619/457-9647.

TurboCards

This line of PDS 68040-based accelerators uses the RAM on the Mac's motherboard, avoiding the need for additional SIMMs on the accelerator card. For the Macintosh IIci, 25MHz, 33MHz, and 40MHz versions are available; and 25MHz cards are available for the LC, LC II, Ilii (adapter required), and SE/30. The 33MHz and 40MHz Ilii models include a 128K cache. LC, LC II, SE/30, Ilii 25MHz \$769; Mac Ilii with adapter \$839; Ilii 33MHz \$1299; Ilii 40MHz \$1699. Focus Enhancements, 617/938-8088, 800/538-8866; fax 617/938-7741.

SOFTWARE

3D Models/Volume 1

Over 50 ready-to-render DXF format models in 10 categories: bookcases, chairs, couches, desks, stools, clocks, glasses, lamps, picture frames, and tables. \$249. Sound/Image, 617/354-4189; no fax.

Bridge Deluxe with Omar Sharif

You'll never again have to find a fourth for bridge—or a second or third for that matter. Learn the basic rules of bridge or refine your slams or defensive plays. This card-playing simulation recognizes the Blackwood and Stayman bidding conventions, and you can take back or rebid a hand at any time. The software includes an on-disk tutorial, and playing hints are available when you get stuck in a tight spot. 2MB min. memory. \$59.95. MacPlay, 714/553-3522, 800/736-5738; fax 714/252-2820.

ChessMaster 3000

Even the Kasparovs and Fischers of the world had to start somewhere, and continues



ChessMaster 3000

COMING THIS SPRING



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New Products

nothing beats a computer for hours of patient instruction and practice. The software features teach and hint modes, multiple board perspectives, a library of opponent personalities, and on-screen advice in conversational English on how to move and why. 4MB min. memory; requires Mac LC, System 7. \$49.95. Software Toolworks, 415/883-3000, 800/234-3088; fax 415/883-3303.

ClassManager/Plus

Classified ads have their own peculiarities, but this software package helps you take placement calls, format the ads, and manage the department. The latest version features WYSIWYG ad construction, a "paste special" hierarchical menu for pasting customer information directly into the ad, a character palette for inserting graphic characters, and style sheets. \$2995. Baseview Products, 313/662-5800; fax 313/662-5204.

ClipEdit

You're set to go on your newsletter—design is done, art is in, but you've got holes where copy should go and no time to write it. This product consists of 35 articles, ranging from 120 to 500 words in length, ready to be cut-and-pasted into a publication. Topics include business, humor, sales and marketing, human resources and personnel, health, and seasons and holidays. \$149.95. Dartnell, 312/561-4000, 800/621-5463; fax 312/561-3801.

Colorize

Put a little color in your life or at least into your black-and-white line art with this paint software. The package features specialized fill tools that combine a standard paint bucket with a brush to precisely place color within the boundaries of an image. Colorize treats each color as a separate layer, reducing file sizes and redraw times, and users can create colors using CMYK percentages and save them in that format for printing; for spot colors, users can output single-color plates. 8MB min. memory; requires System 7, 8-bit color. \$399. DS Design, 919/319-1770, 800/745-4037; fax 919/460-5983.



Crystal Caliburn

Crystal Caliburn

From the folks who brought you Tristram and Eight Ball Deluxe comes another electronic pinball game stuffed full of special targets, ramps, lanes, bumpers, turnovers, and multiball play. Can you bring accolades to all your knights, awaken Merlin, get Excalibur, and find the Holy Grail? 4MB min. memory, requires 8-bit color. \$59.95. StarPlay, 303/339-7016, 800/203-2503; fax 303/330-7553.

Double-XX

If you can write in HyperTalk and use XCMDs, you can develop stand-alone applications. To create an application, you select your resources (XCMDs, PICTs, and so on) and define the menus, and the software creates a shell, complete with a HyperTalk interpreter. The process adds 75K to 150K of additional resources. Requires HyperCard 2.1. \$149, plus \$100 licensing fee per created application for commercial distribution. Heizer Software, 510/943-7667, 800/888-7667; fax 510/943-6882.

Energizer Bunny Screen Saver

As if television ubiquitousness weren't enough, now you can have the Energizer Bunny stomping across your screen and beating his drum while he prevents phosphor burn-in. Bunny ventures through land, sea, and air; users can select or randomize parading, parachuting, gunslinging through the Old West, and snorkeling with sharks. A timer option allows Herr Rabbit to make surprise guest appearances over your applications, and the package also includes a collection of Energizer Bunny desktop wallpaper. 2MB min. memory; 8-bit color. \$29.95. PC Dynamics, 818/888-1741, 800/889-1741; fax 818/889-1014.

form Z 2.3

The real world can be so boring, so why not create one of your own? The latest release of this 3-D modeling software now supports TrueType and PostScript text; extended vertice and edge-rounding tools; shape sweeps along nonplanar paths; and the generation of parallel objects from solids, surfaces, and polylines. The program can now also import EPS, FACT, IGES, STL, RIB, and 3DGF formats. 4MB min. memory; requires FPU, Mac II. \$1495. auto des sys, 614/488-8838; fax 614/488-0848.

FullBack

Automatic file backup is always handy, but this control panel will also keep up to 99 old versions of each file that you work on—no more scrambling back through your notes to rebuild the original version of a document. Optionally, the software will automatically save whatever file you're currently working on at user-specified intervals. \$99. Rochma Technology, 216/573-5854; fax 216/573-5854.

Itemizer

Whether your capital assets are Fuggleman Widgets or Otherness Transistors, accurately tracking them is essential to a healthy business. This software maintains an assets database from information you enter, prints out bar-code labels to help you track your stock, and exchanges information with portable data-collection terminals to ease input procedures. Requires 12-inch monitor. \$695. DataDesigns, 210/697-0780; no fax.

Jeopardy

Ask your Macintosh questions it actually has the answers to, and win fabulous cash and prizes. This computerized version of the television game show *Jeopardy!* continues

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Jon Harms, V.P. Information Services, Val-Pak DMS, Inc.
Leading-edge Macintosh Desktop Publishing Center



Alta-20GB



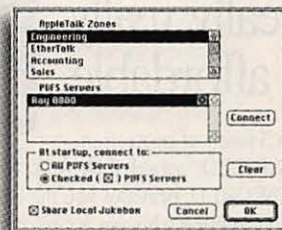
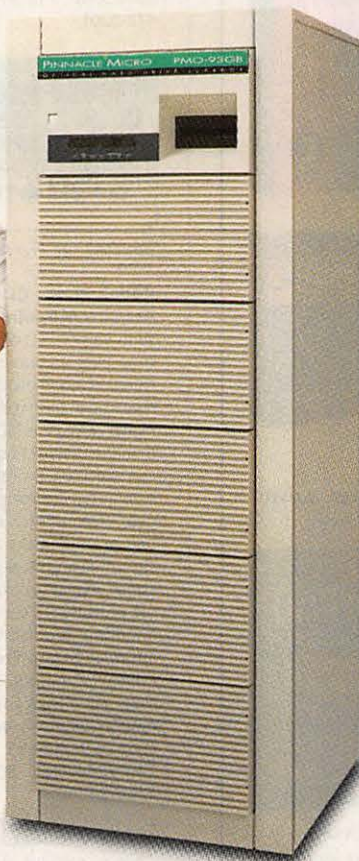
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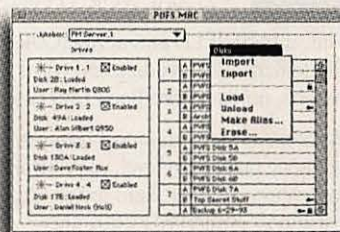
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PVFS has built-in network support which allows you to easily set up jukebox servers for use over an AppleTalk network. Remote users can manually connect to a PVFS server or specify a PVFS server to automatically connect to at startup.



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- Add or change passwords
- Add or remove disks
- Make aliases of jukebox disks
- Erase disks

Introducing a major breakthrough in mass storage! The new Pinnacle optical library storage systems from 20-186 Gigabytes provide lightning fast on-line storage and include Pinnacle's Virtual File System (PVFS™) software. PVFS™ allows the library system to act and feel like one logical volume (one icon). Just double-click to access any file and Pinnacle's library systems will do the rest by automatically locating and retrieving all the data for you.

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PVFS™ includes utilities to format, initialize and catalog optical disks in the system. PVFS™ is compatible with Retrospect™ software which allows for unattended backups using the entire capacity of the library system.

Now there is finally a storage system that can put all your optical disks on-line and make them accessible across a net for everyone to use. Pinnacle's optical library system will help you manage Gigabytes of data into the future. For more information please call:

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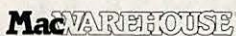
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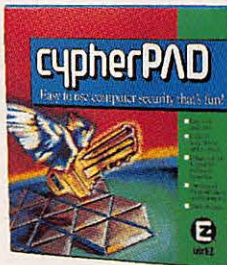
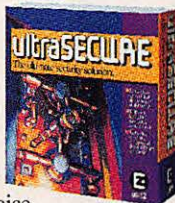
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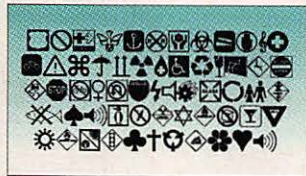
New Products

tures the digitized voice of Alex Trebek and the "Jeopardy" theme music, plus over 3000 questions in over 500 categories. 2MB min. memory; requires 8-bit color. \$39.99. Gametek, 305/935-3995; fax 305/932-8651.

Just Dingbats:

Signs and Symbols

The first of six volumes of TrueType picture fonts, this collection includes 150 images of road signs, medical symbols, postal symbols, recreation signs, safety warnings, transportation warnings, environmental symbols, and handicap symbols. \$69.95. The Communications Shop, 716/473-1650; fax 716/473-5201.



Just Dingbats: Signs and Symbols

Kodak Photo CD

Acquire Module

With version 2.0 of this Adobe Photoshop plug-in, you can acquire images stored in Pro Photo CD Master discs—a new Kodak format that stores images at higher resolution (4096 by 6144 pixels) than the original Photo CD format. You can select any available Photo CD resolution; crop the image; and adjust brightness, saturation, and color balance before loading the image into Photoshop, making it easier to match RGB screen images to color output. The module provides 21 conversion metrics for importing the native PhotoYCC color information into Photoshop, including PhotoYCC output, gray-scale conversion, video RGB conversion, and nine monitor setups. Requires Adobe Photoshop 2.0. \$59.95. Eastman Kodak, 716/724-4000, 800/242-2424; fax 716/724-9624.

Maple V Release 2

College calculus dropouts need not apply for this symbolic and numeric calculation software. The latest version features new mathematical functions, an improved user interface, enhanced support for two- and three-dimensional graphics, and improved printed output. \$795. Waterloo Maple Software, 519/747-2373, 800/267-6583; fax 519/747-5284.

MultiClip Pro 3.0

Software that lets you cut or copy a series of items and then paste them in any order. The software can handle nearly any data type, and the new version allows unlimited collections of clipboards to be open simultaneously; can find clipped items by format, text, and keywords; supports hot keys; and includes full-featured image and text editors. Requires System 7. \$149. Olduvai Corp., 305/670-1112, 800/548-5151; fax 305/670-1992.

newFaces Fall '93 FontPak

Putting a new face on your work—a new typeface, that is. These 11 new

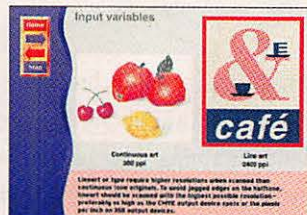
fonts include Improv, based on the credits from 1960s TV comedies; East Bloc, which emulates the Cyrillic alphabet style of 1920s Soviet propaganda posters; Mini Pics, an American Sign Language picture font; Letraset Balmoral, an elegant script face; and two new versions of the Caslon face. All typefaces are available separately and ship with both TrueType and PostScript versions. \$109; \$19 to \$29 per typeface. Image Club Graphics, 403/262-8008, 800/661-9410; fax 403/261-7013.

Nightingale

The next time a three-movement symphony just pops into your head, you might want to have some MIDI notation-and-composition software handy. This package features real or step-time MIDI recording and playback, note entry from the Macintosh keyboard, and text and lyric entry. You can also transpose and extract individual parts with multi-measure rests, and easily place dynamics, articulations, accents, and tempo changes. The software supports automatic note spacing, and it will print out individual and combined scores. 2MB min. memory. \$495. Temporal Acuity Products, 206/462-1007; fax 206/462-1057.

PhotoByte

Getting 1000 words for your pictures is always easier than getting \$1000 for them, but this FileMaker Pro-based office-management software can make the financial end of professional photography easier to manage. PhotoByte automates the creation of job sheets, estimates, invoices, and model releases; tracks the circulation and sales of your photos; files assignments with pictorial references; and computes day rates. The software includes a client and contact database where you can log calls and meetings, and from which you can develop marketing and mailing lists. Requires FileMaker Pro 2.0. \$795. VerTeX Software, 415/331-3100, 800/837-8399; fax 415/331-3131.



Pixel Ink Resolution Disk

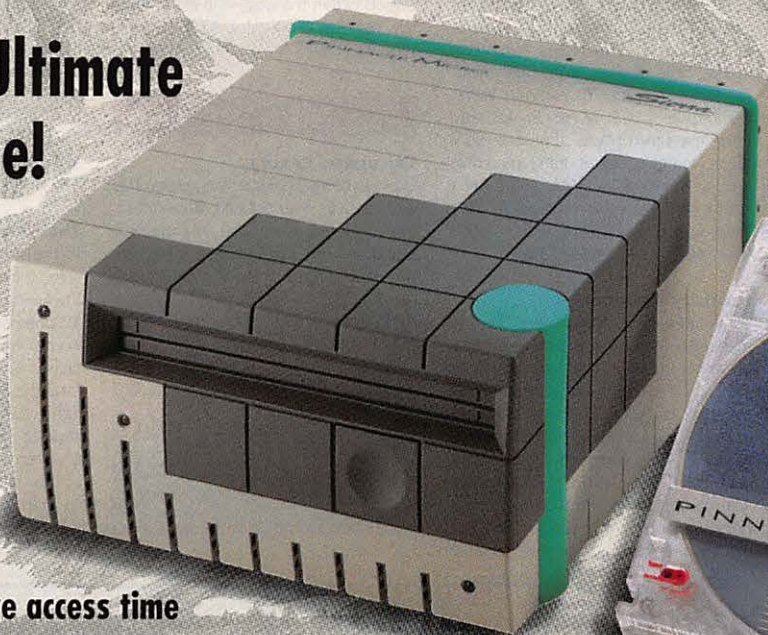
Pixel Ink Resolution Disk

Do you know the difference between dpi, ppi, lpi, and pixel depth? If you're one of the many illustrators, designers, and publishers who don't, this interactive tutorial will answer many of your questions on scanned-image, monitor, and output resolution: At what resolution should you scan line art versus continuous-tone images? How do file size and output device relate to input resolution? What's the trick to keeping blends band-free? Written in Macromedia Director, the tutorial includes a glossary of terms, plus equations for determining image resolution, file size, available grays, and continues

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New Products

percentage of color change. \$32. Pixel Ink Consultants, 415/564-0962; fax 415/564-9677.

PowerBits Jr.

An Adobe Photoshop plug-in that exports RGB images up to 36 inches wide by 25 feet long to an HP DesignJet 650C large-format color ink-jet printer. The plug-in supports serial, Centronics, LocalTalk, and Ethernet connections and uses the DesignJet's language, eliminating the need for a PostScript interpreter. Requires Adobe Photoshop 2.0. \$500. Colossal Graphics, 415/328-2264; fax 415/328-1513.

Print Juggler

Diving into the Chooser over and over again to switch printers gets old—fast. This background application runs invisibly, monitoring user-specified network printers (even across AppleTalk zones). The software puts up a permanent menu-bar item, accessible from any application, that lists selected printers as menu items, displays their status when highlighted, and chooses one when you select it from the menu. Users can control how often the application polls the printers, and can create desktop icons for drag-and-drop printing to specific printers. Requires System 7. \$49. Sonic Systems, 408/736-1900, 800/535-0725; fax 408/736-7228.

Propagator

Create your very own neural networks in the comfort of your living room with this point-and-click development system. An

included manual guides novices through the creation of a network, while experienced neural networkers can control network parameters down to learning rate, number of layers, momentum, initial weights, and stopping criteria. The software can also use a validation set to determine when the network is over-learning and training should be stopped. Requires Mac II, FPU. \$199. ARD Corp., 410/997-5600, 800/969-2731; fax 410/997-3902.

SCSI Director Professional 3.0

This utility is about the SCSI, the whole SCSI, and nothing but the SCSI. Users can format, partition, protect, and maintain SCSI devices, including removable media, SCSI-2 units, and most major CD-ROM formats. The software works with Apple's SCSI Manager 4.3, and offers users the options of multiple SCSI buses, multiple logical units, asynchronous SCSI I/O, SCSI DMA, and Level 1 software RAID (disk mirroring). \$99. Transoft Corp., 805/565-5200, 800/949-6463; fax 805/565-5208.

Territory Manager

Sometimes, the only time you have, to manage contacts and sales leads is a couple of minutes in a hotel lobby between cold calls. Territory Manager streamlines the tasks of record keeping, call management, and appointment scheduling. It also provides several check-boxes for each entry; these let the software analyze contacts and create sales projections, indicate which activities are the most effective, and identify possible

future leads. 2MB min. memory. \$295. Software Solutions, 812/477-3181; fax 708/752-0220.

Visual Music

Those of you who missed out on the color and music experiments of the late sixties can now experience freaky psychedelia or calm pastel washes in time to your favorite MIDI tunes. This software combines a paint program, an animation module, and a 24-track MIDI sequencer that can trigger color, form, and motion effects. Users can load up to 20 PICT files, and manipulate regions or objects within the files. 4MB min. memory; requires 8-bit color. \$200. Ancestors, 206/367-0795; no fax.

CD-ROMS

Calculated Beauty

Explore the vistas of fractal graphics. This disc contains over 600MB of raw data, precalculated from the Mandelbrot equation. Included software interprets the data and can generate over 6000



Calculated Beauty

square feet of fractal patterns. The package also includes fractal shareware programs, QuickTime movies, and a gallery of fractal art. 4MB min. memory; requires color, System 7. \$44. Rocky Mountain Digital Peaks, 303/258-3779, 800/266-7367; no fax.

Myst

An adventure game with no inventories and no time limits? The story begins when you pick up a battered old book, begin to read it, and are suddenly transported to a fantasy world of equal parts technology and magic. Written by Rand and Robyn Miller, authors of The Manhole, Cosmic Osmo, and Spelunx and the Caves of Mr. Seudo, this game offers graphic worlds to explore, puzzles to solve, and a mystery to unravel. 2.5MB min. memory; requires 8-bit color. \$59.95. Brøderbund Software, 415/382-4400, 800/521-6263; fax 415/382-4419.

The New Kid on the Block

In the spirit of computing for youngsters, this disc is the next installment in the Living Books series. Jack Prelutsky's 18 poems range in topic from dogs to homework to siblings. As in the other Living Books, colorful graphics illustrate the text. Clicking on a noun highlights the corresponding picture, and clicking on a verb starts an animation. Children can explore at their own pace, or they can have the poems read aloud to them. 4MB min. memory; requires 8-bit color. \$39.95. Brøderbund Software continues

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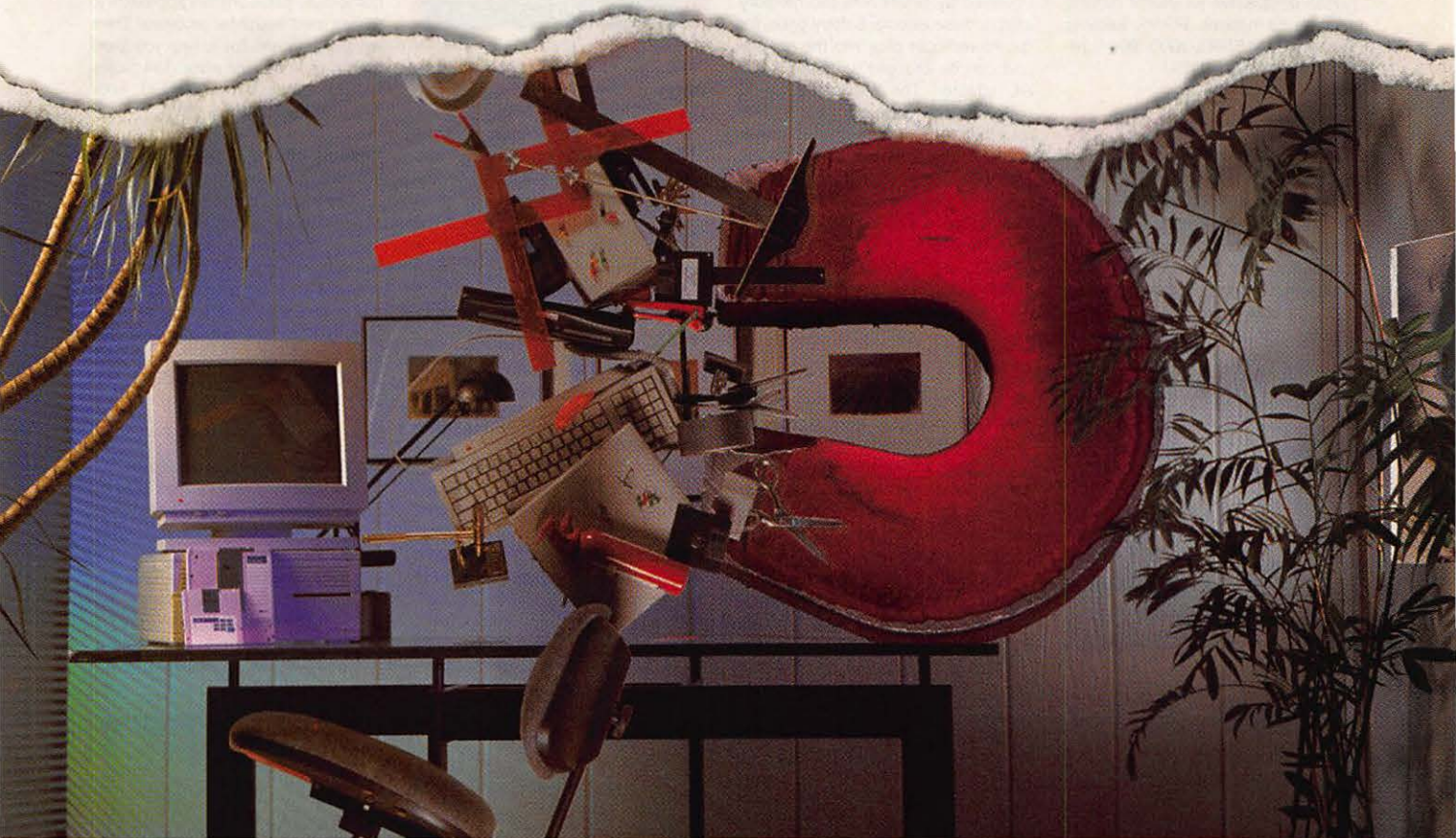
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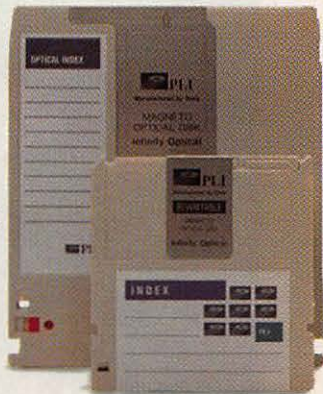
\mis-hap\ *n* **1**: an unfortunate accident resulting in data loss and media failure



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ware, 415/382-4400, 800/521-6263; fax 415/382-4419.

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ACCESSORIES

Mac Liberty

Now you can switch resolutions on the fly without changing monitor cables by placing this adapter between the monitor and your Mac. Users set the desired resolution (up to the maximum supported by the computer) with a dial on the adapter, and the adapter sends the



Mac Liberty

appropriate sense code to the Mac. The adapter supports different sync signals used by the LC and PowerBook models. A PC monitor version is also available. \$34.95. Enhance Cable Technology, 408/293-2425, 800/343-2425; fax 408/293-2468.

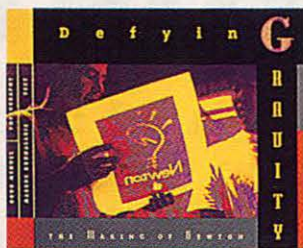
Mac'si Pac 3500 and 7000

Powered by NiMH cells (no memory effect), these external battery packs for the PowerBooks plug into the AC jack and can be charged with the Apple AC adapter. The Mac'si Pac 7000 weighs in at 2.4 pounds and provides roughly 10 to 12 hours of full-power operation for a PowerBook 160. The Mac'si Pac 3500 weighs 1.2 pounds and can run a PowerBook 160 full-bore for about 5 to 6 hours. 3500 \$169.95; 7000 \$279.95. S&K Manufacturing, 515/673-6930, 800/952-8972; fax 515/673-8602.

BOOKS

Beyond Paper

Electronic documents get a workout in this guidebook to understanding the key components of Adobe's Acrobat technology. Readers learn how to use Acrobat to streamline the memo process, create a project proposal, and manage document environments. The book centers around case studies based on real-life situations. Written by Patrick Ames. 127 pages. \$16.95. Hayden Books, 317/581-3500, 800/428-5331; fax 317/581-3550.



Defying Gravity: The Making of Newton

Defying Gravity: The Making of Newton

The inside story on the making of the device that put PDA on everyone's lips. Writer Markos Kounalakis and photo-journalist Doug Menez were given inside access to the Newton team at nearly all stages of development. They describe the late-night programming sessions, the intense pressures, and the successes and failures of bringing Newton technology to the market. 192 pages. \$29.95. Beyond Words Publishing, 503/647-0140; fax 503/647-5114.

DiskDoubler and AutoDoubler: An Illustrated Tutorial

Get the most out of Symantec/Fifth Generation's file-compression utilities. This tutorial walks readers through the vagaries of compressing, combining, and splitting files; compressing system files; speeding up copying; and using the Desktop Reset, DiskTester, DD Verify/Repair, Lock, and Unlock utilities. Written by Marvin Bryan. 160 pages. \$16.95. Windcrest/McGraw-

Hill, 717/794-2191, 800/822-8158; fax 717/794-2080.

Murphy's Laws of Macs

Murphy's laws and computers were made for each other—who was it that said, "To err is human, but to really screw things up requires a computer?" This book by Maria Langer takes a humorous, plain-English approach to solving most basic Mac problems. There are also hints and tips to help you avoid difficulties in the first place. 354 pages. \$12.99. Sybex, 510/523-8233, 800/227-2346; fax 510/523-2373.

ResEdit All-Night Diner

Pull up a chair and browse through these ResEdit recipes for personalizing your Macintosh by altering default icons, menus, dialog boxes, and other basic software features. The book assumes no previous knowledge of programming, and comes with ResEdit and resource files. Written by Dave Ciskowski. 160 pages. \$24.95. Hayden Books, 317/581-3500, 800/428-5331; fax 317/581-3550. **m**

To have your product considered for inclusion in *New Products*, send an announcement with product name, description, minimum memory, peripherals required, pricing, company name, and phone number to New Products Editor, *Macworld*, 501 Second St., San Francisco, CA 94107. *Macworld* reserves the right to edit all product announcements.

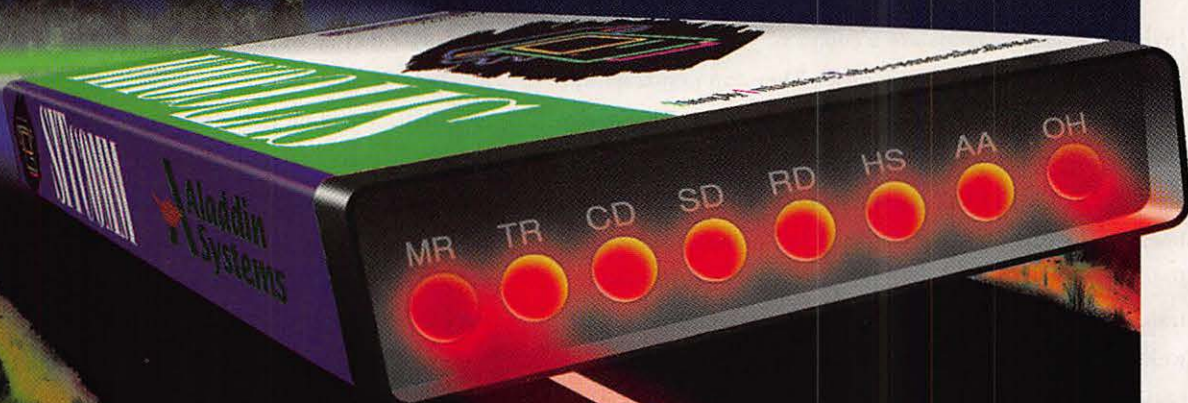
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Circle 23 on reader service card

Semi-pro.



HP SCANJET II CX

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Reviews

PowerBook Duo 270c

Active Matrix Notebook Computer

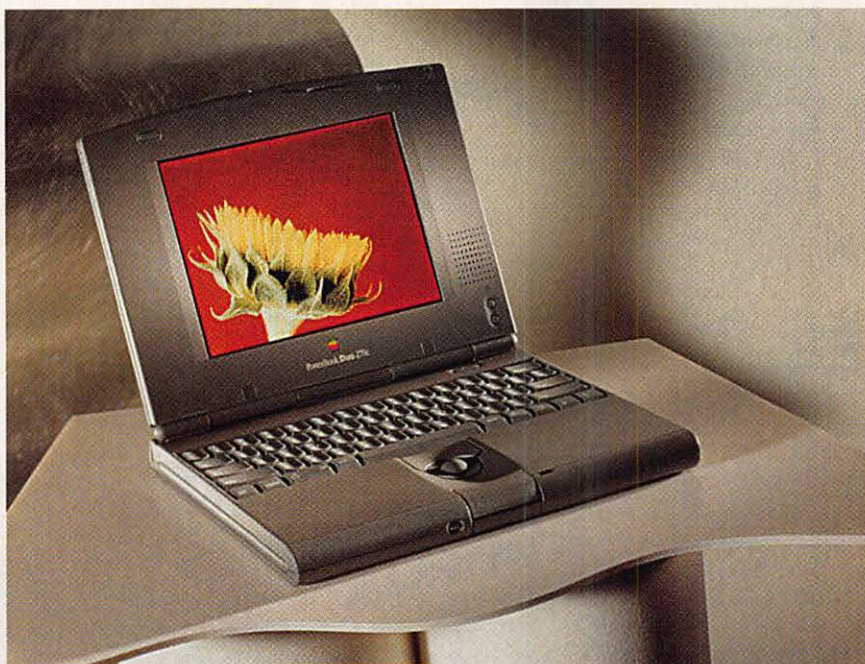
PROS: Offers both 8-bit and 16-bit built-in color display; new Type II nickel-metal-hydrate battery increases battery life; 33MHz 68030 CPU, 68882 math coprocessor, and large storage and RAM (up to 32MB) capacities make it suitable for processor- and memory-intensive applications. **CONS:** Requires a docking station to connect to a floppy drive, external hard drive, external monitor, and so on; lacks a full-size keyboard. **COMPANY:** Apple Computer (408/996-1010). **SUGGESTED PRICE:** \$3099 (240MB hard drive and 4MB of RAM); \$3619 (240MB hard drive, 12MB of RAM, and Express Modem).



IF YOU'RE WORKING AT HOME OR ON the road, no one can blame you for being fussy about what notebook computer you buy. If you're going to carry one on the plane, you want it to be lightweight. If you'll be staring at it for hours in hotel rooms or your living room, you want a colorful display that's easy on the eyes. If you're going to be working when you could be doing something else, you want a battery that's as devoted to working as you are. You want a PowerBook Duo 270c.

When the first Duos (210 and 230) shipped in the fall of 1992, folks marveled at the technology—attached to a docking station, it's a desktop Macintosh; on its own it's a light and efficient traveling companion. The promise was great. The reality, however, was that a lack of docking stations and a passive matrix display proved for less than ringing endorsements where it counts—at the cash register.

This Duo is different. The new PowerBook Duo 270c meets all the demands of notebook users: it weighs less than 5 pounds, features a color active matrix display,


MARK JOHANN

and offers between two and four hours of battery life thanks to a new Type II nickel-metal-hydrate (NiMH) battery. It's the first notebook to offer both 8-bit (256 colors) and 16-bit (thousands of colors) color on the built-in display. And its 152-pin PDS (Processor Direct Slot) connector lets you use any one of about a dozen docking-station options.

Of course, the 270c still faces some of the limitations inherent in the Duo design. That is, it has a smaller than full-size keyboard. You need a docking station to connect such things as a floppy drive, an external monitor, an Ethernet network, a second hard drive (or to use your Duo in SCSI Disk Mode), and so on. But on the road, most of us can get by with a modem and the LocalTalk port, which don't require a docking station. I found that the Duo 270c's slim design more than made up for having to travel

without the safety net of a floppy drive. However, I was also occasionally frustrated when I needed to dig out my docking station and floppy drive to load a new program or utility software. Once the Duo was stocked with software, my reward was a slim portable companion that let me squeeze in another 45 minutes of work after I boarded the commuter train at night.

Color Options

Only a small percentage of notebook computer users need color. That doesn't mean they don't demand it. The 270c's screen shines brightly in 640-by-480-pixel resolution, 256-color mode—and more brightly in 16-bit, 640-by-400 mode. If you require 16-bit color to view images with thousands of colors, you can change the color options in the Monitors control panel. Unfortunately, you must

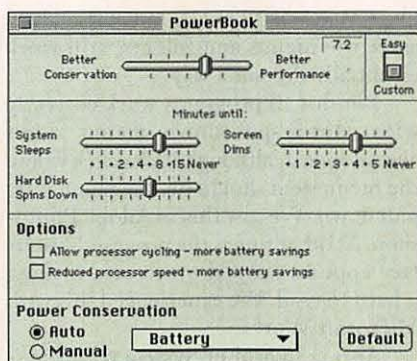
restart your Duo for the change to take effect, which is a bit of a drag. The other hitch is that when you change the screen resolution to 640 by 400 pixels, you basically cut off the top and bottom .5-inch of the screen. The result is a look that resembles a letterboxed movie. As with viewing letterboxed movies, though, it doesn't take long for your eyes to adjust. But for typical use such as word processing or using a spreadsheet, you'll want to stick with the 640 by 480 view. After all, the desktop real estate on the Duo's 8.4-inch screen is small enough without giving up 80 pixels of vertical space.

The color active matrix screen not only adds to the 270c's price but also adds slightly to the 270c's bulk. This Duo weighs about .5 pound more than previous Duos. The color display also makes the 270c .10 inch taller than the 250, 230, and the recently discontinued 210. This small increase in height is trivial unless you already own an Apple Duo Dock. In that case, you need to upgrade your Duo Dock (\$69) to accommodate the 270c.

Battery Life and Performance

Apple claims that the Duo 270c's new Type II NiMH battery will last between two and four hours. Running the Duo full out, with no power-management features activated, I found just under two hours to be a realistic estimate. But for less strenuous uses—when I wasn't taxing the hard drive or the processor and I was using battery-management features (dimming the screen, turning down the processor speed, and so on)—I was able to squeeze close to four hours of use from the Duo 270c.

One useful new power-management feature is the capability to set different configurations for battery and AC power. When your 270c is running off the power adapter, the software recognizes this and implements the settings you've chosen for



Power Management The PowerBook Duo 270c features a new control panel for better battery management. The software recognizes whether the Duo is using AC or battery power and adjusts the settings automatically. Here the 270c is using the configuration defined for battery operation.

AC power. Your 270c also knows when it's running off the battery and adjusts power settings accordingly.

In addition to new battery technology and power-management features, the 270c boasts serious horsepower: a 33MHz 68030 CPU and a 68882 math coprocessor. In Macworld Lab testing, the 270c slightly outperformed Apple's other color PowerBooks—the 180c and 165c (see "Duo 270c: How Fast Is It?"). But in our display tests, the 270c was more than twice as fast as the 180c, which uses the same active matrix screen. The increase is due to a new custom ASIC that both increases the speed of 8-bit color performance and adds 16-bit color capabilities.

We tested the 270c in both 8-bit and 16-bit color modes. We found no performance difference between the modes in processor, math, or drive-access tasks. In our display test, which includes several tests that measure scrolling speed, 16-bit mode was 68 seconds slower than 8-bit mode, which makes sense because it requires processing twice as many color

bits. Our test unit came stocked with a 240MB hard drive and 12MB of RAM, which can be expanded to 32MB.

What's Not to Like?

The Duo 270c has a lot to like, but it's not without its shortcomings. If you require a notebook with a full-size keyboard, you don't want a Duo. While I'm not the most accurate touch typist, my typing was worse than usual. And if you're used to the PowerBook's trackball, you'll find yourself searching for the much smaller Duo trackball. And the lack of a built-in floppy drive is an inconvenience.

The Duo 270c's small form doesn't mean it carries a small price tag. For the base configuration (240MB hard drive and 4MB of RAM), expect to pay a little more than \$3000. Add a modem, extra RAM, and Apple's Floppy Disk Adapter and drive, and you're up to about \$3900. If you opt for a more full-featured docking station (one that supports large monitors or offers SCSI or Ethernet ports), you're up to around \$4400. A maxed-out Duo 270c is a lot of computer, but if you're inclined to compare prices with the Windows world, you can find a color active matrix 486 notebook for about the same price or perhaps a little less.

A Dynamic Duo

After living with the Duo 270c for two weeks, I've grown accustomed to its bright and colorful face and slim and trim physique. I don't mind working away from the office, but I don't want to carry a lot of extra weight to do so. The Duo fits easily into my briefcase. In the real world of overhead compartments, connecting flights, urban transportation, and crowded kitchen tables, the Duo 270c makes working on the road an almost pleasant experience—and that's saying something.—DAN MUSE



Duo 270c: How Fast Is It?

CORE PERFORMANCE INDEX

Times as fast as a Classic (Classic = 1.0).

Use these standard ratings of overall performance, based on a core test suite, to compare systems across classes.

Common

Typical business tasks in Microsoft Excel and Word that use the Mac's processor, drives, and video display.

Scientific

We added to the common tasks several scientific calculations that use floating-point math.

NOTEBOOK-SYSTEM PERFORMANCE TIMES

Times are in seconds. Shorter bars are better.

Use these results to compare the performance of systems for different types of real-world business tasks. The results can be compared with any other Macworld Notebook System Performance Times.

Processor

Our tests included recalculating a spreadsheet, finding and replacing a word in a word processor, and sorting a database.

Drive-Access

Our tests included opening files and sorting a database (on disk).

Video-Display

Our tests measured scrolling speed in Microsoft Excel and Microsoft Word.

Floating-Point

Our tests included recalculations involving scientific functions.

■ Best result in test. Products are arranged in decreasing order of overall performance.

Duo 270c (640 x 480, 8-bit color)*	5.7	11.7	35.1	46.9	81.8	39.7
Duo 270c (640 x 400, 16-bit color)	5.4	11.3	35.1	46.9	149.6	39.7
PowerBook 180c (640 x 480, 8-bit color)	5.1	10.8	36.1	52.1	167.2	41.9
PowerBook 165c (640 x 400, 8-bit color)	5.1	10.9	35.9	54.0	158.0	41.2

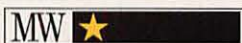
*The screen size (in pixels) and the screen's bit depth are given in parentheses after the product names.

NuTek Duet

Mac Work-Alike

PROS: Compatible with many standard programs. **CONS:** Incompatible with some standard programs, most hardware add-ons, and most System 7 features; slow video display.

COMPANY: NuTek USA Corporation (408/973-8799). **LIST PRICE:** \$2996.



COMPATIBILITY IS THE KEY TO clone-making. Ask the dozens of companies that, in the early eighties, offered alternatives to the IBM PC but foundered for lack of compatibility. A decade later, NuTek USA has released a Macintosh work-alike developed independently of Apple. (We call this work-alike a Mac, although technically it is not.) Its test, too, will be compatibility.

The NuTek Duet is two computers in a single tower case: a DOS PC with a 66MHz Intel 80486DX2 CPU and two ISA 16-bit expansion slots; and a Mac with a 33MHz Motorola 68030, 68882 FPU, two standard NuBus slots, and a SCSI port. Each system has its own 170MB hard drive (IDE for the PC, SCSI for the Mac); the video circuitry, keyboard, and mouse are shared. The mouse uses a standard IBM PS/2 connector, and the keyboard uses the standard AT connector. There is no ADB port for Mac input devices.

Both computers can run simultaneously, but you can't view both at once in separate windows; a switch on the case lets you toggle between the two systems. There is no way to cut and paste data directly between Mac and Windows programs, although you can copy files between them.

Why two computers in one? NuTek says it's for people who mostly use DOS or Windows but need to use a Mac occasionally. That makes it similar to the Orange Micro OrangePC board that puts a 486SX-based PC in your Mac (see *Reviews*, *Macworld*, October 1993) and to Apple's Quadra 610, DOS Compatible (see *News*, *Macworld*, in this issue).

How It Feels

It was interesting to experiment with the computer's interface, which is based on the Open Software Foundation's Motif interface popular on Unix workstations. NuTek used Motif so Apple couldn't claim copyright infringement. The result is a Mac work-alike that doesn't feel much

like a Mac. That's not in and of itself bad, since the menus and folders still work essentially the same way.

But not all programs work correctly with Motif—pull-down menus don't always appear, although if you click where the menu item should be, the menu does pull down. We saw this in Adobe Photoshop. At other times, the program's interface appears warped on screen, making it hard to read. We experienced this with Microsoft Works.

Also, a hybrid of System 6 and System 7, the Duet is out of step with how a Mac works today. Among the missing features are drag-and-drop editing, publish and subscribe, aliases, and file sharing.

How Fast Is It?

The Duet's 33MHz 030 gives it about the same power as a IIx or Performa 550. And NuTek's emulation doesn't get in the way of that power—with one notable exception: very slow video performance compared with a Mac's, making the entire system appear sluggish for work involving screen redraws. Furthermore, the NuTek uses minimum-standard Super VGA video circuitry, so 16-inch and larger monitors have noticeable flicker.

The benchmarks, "How a Duet Compares," show the performance of both the Mac half and the PC half in relation to similar Macs and PCs. We used our entry-level test suite, which is appropriate for the 030's capabilities. Our test configuration was a standard Duet upgraded to 16MB of RAM for the Mac half and 8MB for the PC half, with a 17-inch color monitor. What the benchmarks don't show is the extremely long waits you face when switching between applications—often 5 to 10 seconds.



The NuTek Duet

Compatibility Trials

The Mac part of the Duet uses NuTek's own operating system, the NuTek OS, which was designed for compatibility with Mac applications but uses none of Apple's proprietary code.

To run Mac software, the NuTek operating system intercepts the system calls issued by programs and translates them to a form the Duet system board and ROM can understand. The danger with this approach—especially since NuTek could not use any Apple code or technology—is that there may be incompatibilities with programs that do not work as the NuTek engineers expected.

NuTek clearly didn't learn the compatibility lesson of a decade ago. This Mac work-alike runs many standard business programs, but there are some glaring omissions, such as Aldus PageMaker. Some system extensions worked, but others caused problems. For example, the shareware PopChar control panel prevented start-up, while the Mainstay Capture control panel caused no trouble. And NuTek warns against using Norton Utilities for the Macintosh or similar products, since the Duet's non-Mac file structure would confuse them and cause them to damage data in a misguided effort to fix "bad" files.

Some software incompatibilities were obvious: the program wouldn't load or the system would crash, as happened with PageMaker and Macintosh PC Exchange. Other incompatibilities were more subtle. For example, Fractal Design Painter 1.2 worked fine—until we tried to quit, and then the system froze. Other cases were erratic, like Aldus FreeHand 3.1, which caused a freeze, but only the first time we used it.

But compatibility goes beyond being able to run spe-



How a Duet Compares

CORE PERFORMANCE INDEX

Times as fast as a Classic (Classic = 1.0).

Best result in each test in each category.

Products are arranged in decreasing order of overall performance.

Use these standard ratings of overall performance, based on a core test suite, to compare systems across classes.

Common

Typical business tasks in Microsoft Excel and Word that use the Mac's processor, drives, and video display.

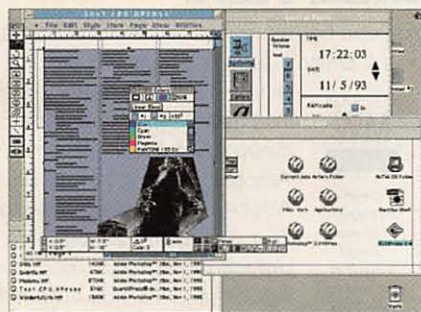
Scientific

We added to the common tasks several scientific calculations that use floating-point math.

Macintosh		
Quadra 605	10.3	10.8
Performa 460	5.0	5.2
IIci	4.9	9.2
LC III	4.0	4.1
NuTek Duet	3.8	8.8
IIx	3.3	3.3
LC II	1.9	1.9
Windows PC		
66MHz 486DX2	22.6	61.7
NuTek Duet	20.8	56.5
33MHz 486DX	13.2	30.4

cific applications. A Mac work-alike should handle standard SCSI and NuBus peripherals, for example. Chances are the Duet won't. All we could get to work consistently was an external modem and non-Apple laser printers.

It first appeared that CD-ROM and SyQuest drives simply wouldn't mount, and most drive mounters never even saw them on the SCSI chain. Sometimes just having these devices attached to the SCSI chain prevented the Duet's Mac half from starting up. We had to call a NuTek technician for help. The result was that the Apple CD SC drive would not work, but the Texel DM5028 drive would—if we used the Trantor driver. Those devices we could get to work, such as external hard drives, functioned only in a limited way. For instance, we couldn't start up from an external hard drive. NuTek's technician solved that problem by moving some System files to different folders. For SyQuest drives, only certain SCSI IDs would work.



The NuTek interface bears only a passing resemblance to the Macintosh's.

Compatibility also means supporting core system services, like networking. Again the Duet fails, not supporting LocalTalk (except connections to printers), Ethernet, or even System 6 AppleShare. (As with external drives, you can install LocalTalk or Ethernet cards in the Duet's PC slots, but that doesn't help in Macintosh mode.)

Even some built-in features don't work right. Take the Duet's built-in Super VGA video circuitry. It supports 8-bit, 16-bit, and 24-bit color depth at 640-by-480-pixel resolution, and you can change resolutions on the fly (to 800 by 600 at 8 bits or 16 bits, or to 1024 by 768 at 8 bits) from the Duet's version of the Finder's Special menu. However, the color depth does not work. When we switched from 8-bit to 16- or 24-bit and restarted, the on-screen display either stayed at 8-bit or changed to monochrome. Sometimes the colors changed.

Particularly unnerving was that the NuTek engineer—not just a support tech—assigned to help us admitted that

NuTek didn't test compatibility with networks and video cards.

And not all incompatibilities are on the Mac side. The PC half of the Duet at times started up without loading the mouse driver. Fortunately it's easy to load the mouse driver from DOS. A tougher problem lies in a flaw in the Duet's scheme for copying data between the Mac half's hard disk and the PC half's hard disk. Mac files copied to the PC may not appear in the PC directories; similarly, when deleted, they may remain in the directories. The problem is in the PC half's cache, which is not updated with the new directory information. NuTek included a utility to update the cache manually—an inelegant work-around.

A Few Bright Spots

The Duet uses a PC-style two-button mouse. When the Mac half is active, the right mouse button becomes a 400 percent hardware zoom control. (When the PC half is running, the right button does whatever the active program has it set to do.) The Duet also has a special 3.5-inch drive that reads and writes Mac 800K, Mac 1.4MB, PC 720K, and PC 1.4MB disks. When running in Mac emulation, it even ejects the disk for you (something a standard PC drive can't do).

The idea of Macintosh clones has long appealed to Mac customers uncomfortable buying from a single vendor. The existence of compatible Mac clones would also let third parties fill in niches that Apple cannot or will not specifically address.

But the NuTek Duet does little to fulfill that desire. A PC user who works with a Mac only occasionally is better off using the Windows equivalents of Mac software (see "Working in Two Worlds," *Macworld*, December 1993). If the Mac programs you need to use have no Windows equivalents, buy a cheap Mac. The Quadra 605 and Performa 475 are both thin enough so you could put one on top of your PC.

NuTek also sells an 030-based computer called the One that uses the same system board as the Duet. No review unit was available, but it is just the Mac part of the Duet in a traditional desktop case. It sells for \$1169—and with real 040-based Macs selling for just a couple hundred dollars more (with the keyboard and monitor), there's absolutely no reason to consider it.

Despite the frustrations, we enjoyed experimenting with the Duet because it is so weird. It makes a great novelty item for the techno set. But it's not a computer anyone should consider using for work.

—GALEN GRUMAN AND LAUREN BLACK

WHAT WORKS—AND WHAT DOESN'T

Macworld Lab tested a range of popular business software and hardware add-ons, as well as INITs and System features. Often they did not work, resulting in system freezes, crashes, or other errors.

Compatible Software

- ACI US 4th Dimension 2.2.2
- Adobe Photoshop 2.0 and 2.5
- Adobe Type Manager 2.0 (bundled with the Duet)
- Aldus Persuasion 2.0
- America Online 2.0.1
- Claris FileMaker Pro 2.0
- ClarisWorks 1.0
- Deneba Software UltraPaint 1.05
- Intuit Quicken 3.0
- Microsoft Excel 4.0
- Microsoft PowerPoint 2.0
- Microsoft Word 4.0 and 5.1
- Microsoft Works 2.00b
- QuarkXPress 3.1 and 3.2
- Wordstar WriteNow 3.0

Incompatible and Problematic Software

- Any disk utility, such as Norton Utilities for Macintosh or Central Point Software's MacTools
- Adobe Illustrator 5.0
- Aldus PageMaker 4.2 and 5.0 (5.0 would not install)
- Apple Macintosh PC Exchange
- Apple System 6 AppleShare
- Fractal Design Painter 2.0 (would not install)
- WordPerfect 2.0 and 3.0
- Aldus FreeHand 3.1
- Fractal Design Painter 1.2


Compatible Hardware

- Hayes 9600B external modem
- Hewlett-Packard LaserJet 4M

Incompatible and Problematic Hardware

- Any network card, since the Duet does not support AppleTalk or AppleShare
- Apple LaserWriter (all models)
- Apple Macintosh Display Card 8•24GC video card
- SuperMac Technology's Thunder II video card
- Apple CD-SC external CD-ROM drive (worked only with the Trantor driver bundled with the Duet)
- Any SCSI device (high-numbered SCSI IDs don't always work, so drives often don't mount)

—LAUREN BLACK



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Authorware Professional 2.0.1

Multimedia Scripting/ Presentation Software

PROS: Fast response; extremely capable programming system; full video and sound access; truly interactive; beginners can learn basics in an hour; files transfer easily to Windows. **CONS:** Costs more than most Macs; lacks built-in JPEG compression. **COMPANY:** Macromedia (415/252-2000). **LIST PRICE:** \$4995 (\$995 for educational institutions).



IF YOU'RE PRODUCING MULTIMEDIA instructional material, Authorware Professional 2.0 (henceforth, Authorware) is the only program to consider. This statement may seem extreme, but it's supported by three facts. First, Authorware allows any type of interactivity you can imagine; this includes customizing a course on the fly for each student in response to the student's choices and actions. Second, you can learn how to design such a course with no programming background, although understanding XCMDs and knowing how to write a few external routines can greatly extend your Authorware powers. Finally, although the price is formidable (even the educational price is high by educators' standards), remember that even a modest multimedia project will likely take hundreds of hours. Authorware lets you develop complex productions with amazing speed, and software that enables you to put a project together faster will eventually be a bargain, even if the initial expense is high.

Doing a multimedia presentation per se isn't so demanding any more—if you just need a self-running slide show with sound, movies, and animation, you can do it cheaply and effectively using Gold Disk's Astound, for example. The challenging part of creating instructional multimedia is introducing real interactivity without requiring that the producer master a complex programming language.

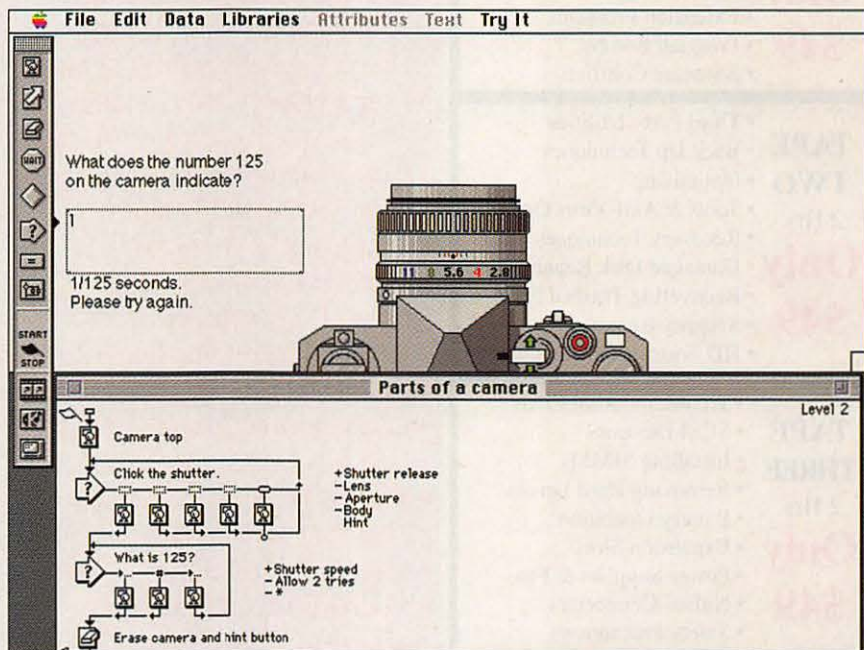
This is exactly Authorware's strength. You organize each presentation by dragging icons from an icon well onto a flow line. If you choose only Display icons, which represent pictures or text, from the icon well on the left side of the screen, you get a standard slide show. (Text handling, by the way, is on a par with that of the best word processors; graphics handling lacks JPEG compression but is otherwise praiseworthy.) Now if you drag the

Interaction icon onto the flow line, you introduce a point in the show at which you ask the viewer for a response—a text answer, a click in a diagram, a choice from a menu, and so on (see "Picks That Click"). In this kind of interaction you would typically be trying to solicit the right answer to a question, presenting hints or other material in response to wrong answers. Thus, using only Authorware's Display and Interaction icons, you can program the equivalent of most current instructional material.

Putting the Decision icon on the flow line really expands the possibilities. Decision lets the program jump to different places in the presentation or call up other resources (text, movies, sounds, and graphics) based on the value of program variables. Authorware supports calculations with variables on Decision branch points, so the presentation program flow can be arbitrarily fancy. For example, if you define a PercentRightAnswers variable to keep track of viewer response, you

materials, but the nature of multimedia demands a huge time investment—designing a good instructional CD is more like producing a television series than writing a book. Authorware streamlines this process somewhat, since it easily supports sequential development of materials, with a first phase of collecting text and graphics and stringing them on a flow line, followed by introducing Interaction and Decision icons at key points in the flow. The details of working with Authorware are simple enough so they never intrude on the process of content planning. Presentations can also be ported to Windows for distribution to unfortunate Mac-less schools, making this a universal solution to instructional multimedia development. The run-time module takes up less than 400K, and the finished presentations are remarkably compact, considering the richness of the content.

Macromedia has done a wonderful, thoughtful job with Authorware Professional 2.0. Although it sometimes seems



Picks That Click The top part of this screen shows the image the viewer sees, while the window below (which would normally be concealed) shows the program flow line.

can have the program swap in easier material or run a video of additional background information if the value of this variable gets too low. Designing a complex, self-customizing presentation obviously takes plenty of planning, but the tutorial and user's guide explain how to do so with admirable clarity.

Authorware is a nearly ideal tool for producing brilliant courses and training

that current thinking about educational reform is centered on finding ways to make grades K through 12 as profitable as a burger franchise, we could probably accomplish more by getting copies of Authorware into the hands of hundreds of first-rate classroom teachers, along with some extra summer income, so they can produce CD-ROM-based courses for distribution.—CHARLES SEITER

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DateBook and TouchBase Pro Bundle

Contact Manager and Personal Calendar Manager

PROS: Good data integration; excellent feature sets; multiuser calendar and contact managers. **CONS:** TouchBase file sizes are large. **COMPANY:** Aldus Corporation Consumer Division (619/558-6000). **LIST PRICE:** \$149.95.



ALDUS CORPORATION'S LATEST revision to its dynamic duo of contact and calendar manager, TouchBase and DateBook, results in the addition of the word *Pro* and a superior combination of integration, usefulness, and features. Originally from After Hours Software, which Aldus acquired in 1993, the two programs are available separately or bundled together. *Macworld* has reviewed both products before (DateBook 1.5.1, February 1993; TouchBase 2.0, August 1992).

The most powerful enhancement to both programs is the improved integration of data via Apple events. Previously, integration was basically one-way: you could look up, copy, and paste a name and address from a TouchBase file into a DateBook calendar entry. Now, while reviewing an entry in TouchBase Pro, you can see all of that contact's appointments, to-do items, and memos entered in DateBook Pro, and you can add or edit any of these without leaving TouchBase Pro. If you are in DateBook Pro, not only can you look up contact data from TouchBase Pro, but you can also edit that data, and dial the telephone number of any linked contact. You can print envelopes and fax cover sheets, or using TouchBase Pro's new FastLetter feature, you can create a quick memo and send it without leaving DateBook Pro. This integration is accomplished through Apple events that allow DateBook Pro to send and display data in a TouchBase Pro window or vice versa.

TouchBase Pro

TouchBase Pro has added several new features since the last release. For the first time, you can simultaneously open multiple TouchBase files. Because the program is multiuser, this feature is especially useful; you can have your company's networked contact file open at the same time as your personal contact file.

FastLetter is a simple built-in word processor. You can create a FastLetter for

one person, or create form letters and use TouchBase Pro for mail merge (simply mark the addresses you want to use in TouchBase Pro and print to FastLetter in the print dialog box). You can also save FastLetter templates for later use.

TouchBase Pro can reconcile two versions of the same file—useful for anyone who uses the contact file on a PowerBook either at home or on the road, and then needs to update the file at the office. File reconciliation in TouchBase Pro is much better than that in Portfolio Software's Dynodex for Macintosh. TouchBase Pro uses a log file that records all changes made to the copy of the database and then uses that log to update the master file. That means if you delete and change some records on the PowerBook, the exact same actions will occur on the master file upon reconciliation. If a contact has changed in both files, TouchBase Pro can alert you, and let you view that record in each file during reconciliation so you can select which version to keep. In contrast, Dynodex compares the contents of each contact record, and overwrites the old record with the new, ignoring record deletions. This means that with Dynodex, if you delete records on the PowerBook, those records will still be part of the master file after you reconcile.

Other changes to TouchBase Pro include historical tracking, so that phone calls made and letters sent are logged into the contact's notes field automatically; a more customizable user interface; a global-replace feature across multiple contacts; and a user-definable facility that prevents you from adding the same contact more than once by comparing the Last Name, Company, or any other field. The program now handles long dialing strings, such as credit card numbers.

A continuing disadvantage of TouchBase Pro, especially for anyone with limited hard disk space, is the large size of data files. My test file of 500 contacts was 50K as a text file, 77K in Dynodex 3.0, and a whopping 411K in TouchBase Pro.

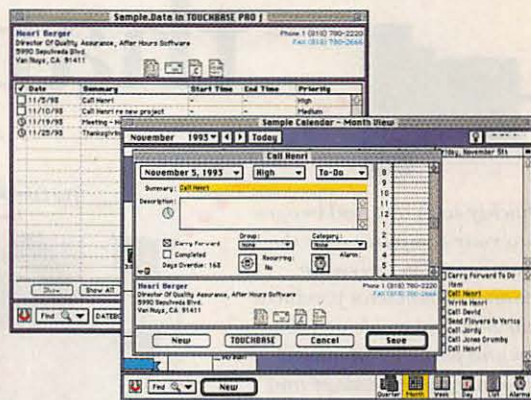
DateBook Pro

DateBook Pro has changed less than TouchBase Pro (partly because it's newer), but the changes make the program easier to use. The memo, a new entry type, allows you to take notes without referencing an event or a to-do item. The

detail field describing any event, to-do, or memo is more spacious. To-do items are now visible in all views, including the weekly view. Unfinished to-do items have always been carried forward automatically, but now you see the number of days the item is overdue.

A DateBook Pro miniwindow allows you to view items in your calendar from the Finder and lets you launch the application or quickly add alarms, events, to-do items, or memos without launching it.

You can now save and name search criteria as custom List views; my Upcoming Deadlines view checks for all deadlines in the next 45 days. A new SearchLight feature lets you search in the list view; then if you switch to a calendar view and click on the SearchLight icon,



Calling All Calendars These two screen shots show the tight data integration between TouchBase Pro and DateBook Pro. In the TouchBase Pro window (rear), the calendar events shown for the contact are actually being sent to and displayed within TouchBase Pro by DateBook Pro; the event data doesn't reside in the TouchBase Pro data file. Similarly, in DateBook Pro (front), the contact data at the bottom of the event Detail window has been linked in from TouchBase Pro.

the program highlights the days matching the items found in the search.

DateBook Pro's printing now offers a print preview; the ability to print events, memos, and to-do items with their associated TouchBase Pro links (so you can print an event along with the address and phone information); and the ability to print large wall charts. Quick Print prints just the current view, whether a calendar view, an event, a to-do, or a memo.

TouchBase Pro and DateBook Pro are both excellent products, and bundled for a street price under \$100, they're a steal. If you want to get organized, make sure that you look at this package.

—TOM NEGRINO

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For Your Information.

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Graphics Software

3-D Design Applications

Infini-D 2.5.1

PROS: Easy to use; cool terrain effects; wide range of animation options. **CONS:** Lacks spline curves; insufficient lighting controls; expensive. **COMPANY:** Specular International (413/253-3100). **LIST PRICE:** \$995.



StrataVision 3d 2.6.3

PROS: Comprehensive modeling capabilities; huge supply of rendering options. **CONS:** Dense, sometimes slow interface; haphazard documentation; difficult to learn. **COMPANY:** Strata (801/628-5218). **LIST PRICE:** \$995.



MANY THREE-DIMENSIONAL DRAW programs allow you to construct models and extrude text, some let you light and render photo-realistic scenes, and some even go so far as to provide animation capabilities. But only a few try to do it all in a single program. Two such programs that have long provided all these functions and have lately seen significant upgrades are StrataVision 3d 2.6.3 and Infini-D 2.5.1. Both are serviceable programs with a wide range of modeling, rendering, and animation options. But while StrataVision 3d provides a superior modeler and a more versatile renderer, Infini-D's straightforward interface, quicker operating speed, and superior animation capabilities give it a slight edge.

Making Models

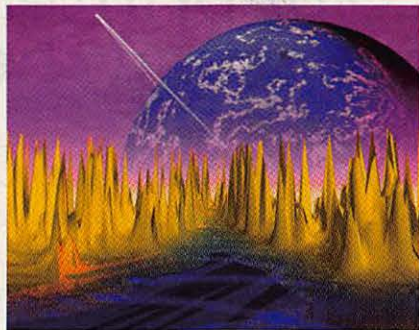
Infini-D arguably provides the most straightforward interface of any Mac program for creating 3-D objects. The program provides tools for quickly knocking out cubes, spheres, cones, and other so-called primitives. To create your own models, you can extrude 2-D shapes, lathe (or spin) them, or draw them in three dimensions by editing them in the front, top, and side views. If you're looking for special effects, you can use the terrain tool to create mountain ranges from automated Mandelbrot Set or Julia Set fractals (see "Life on Planet Fractal").

Unfortunately, Infini-D lacks sufficient modeling functions to attract experienced users. Most glaringly, the program doesn't support spline curves, a fact

that prohibits you from drawing just about any natural form. To make matters worse, you can't edit individual vertex points without resorting to a separate object-editing mode, and even then you sometimes have to redraw shapes. As a small consolation, version 2.5.1 allows you to import 2-D objects saved in the Illustrator EPS format. You can also create special logo effects from PostScript and TrueType fonts. Finally, you can bevel the edges of any model—graphic or text—to carve away sharp corners.

By comparison, StrataVision 3d's modeling environment is a monster, both more powerful and more difficult to grasp. The program offers several primitive tools, including one that draws multiple plane shapes like pyramids and tori (or doughnuts). You can model by extruding, lathing, or sculpting, the last of which automatically converts paint images into 3-D models. You can also wrap a skin around a series of 2-D ribs or sweep a rib around a central axis to create a spiral. (Sadly, you cannot sweep along a path to create free-form extrusions, as in Alias Sketch.) And unlike Infini-D, StrataVision 3d supports splines and vertex editing; you can even edit the Bézier curves of imported 2-D EPS objects.

But you have to be patient when dealing with StrataVision 3d's overly dense



Life on Planet Fractal The planet surface was created using Infini-D's terrain tool combined with a Mandelbrot Set fractal. Portions of the background were imported as a PICT image.

and sometimes sluggish interface. The sheer number of controls and commands will send you scrambling for the manual, which is strangely organized and badly indexed; several entries refer you to more than 20 page-references apiece. (Both StrataVision 3d 2.6.3 and Infini-D 2.5.1 ship with nonindexed addenda to the version 2.0 manuals.) And though StrataVision 3d's screen-redraw rate is faster than it used to be, it's still slower than Infini-

D's, as well as those of more capable modelers like Alias Research's Alias Sketch and Macromedia's MacroModel.

Lighting and Reflection

For the most part, Infini-D's rendering capabilities are what you would expect from a far-reaching 3-D program. It offers professional-quality Phong shading with fog effects and environment mapping—the latter feature wraps the surrounding scene onto an object. If

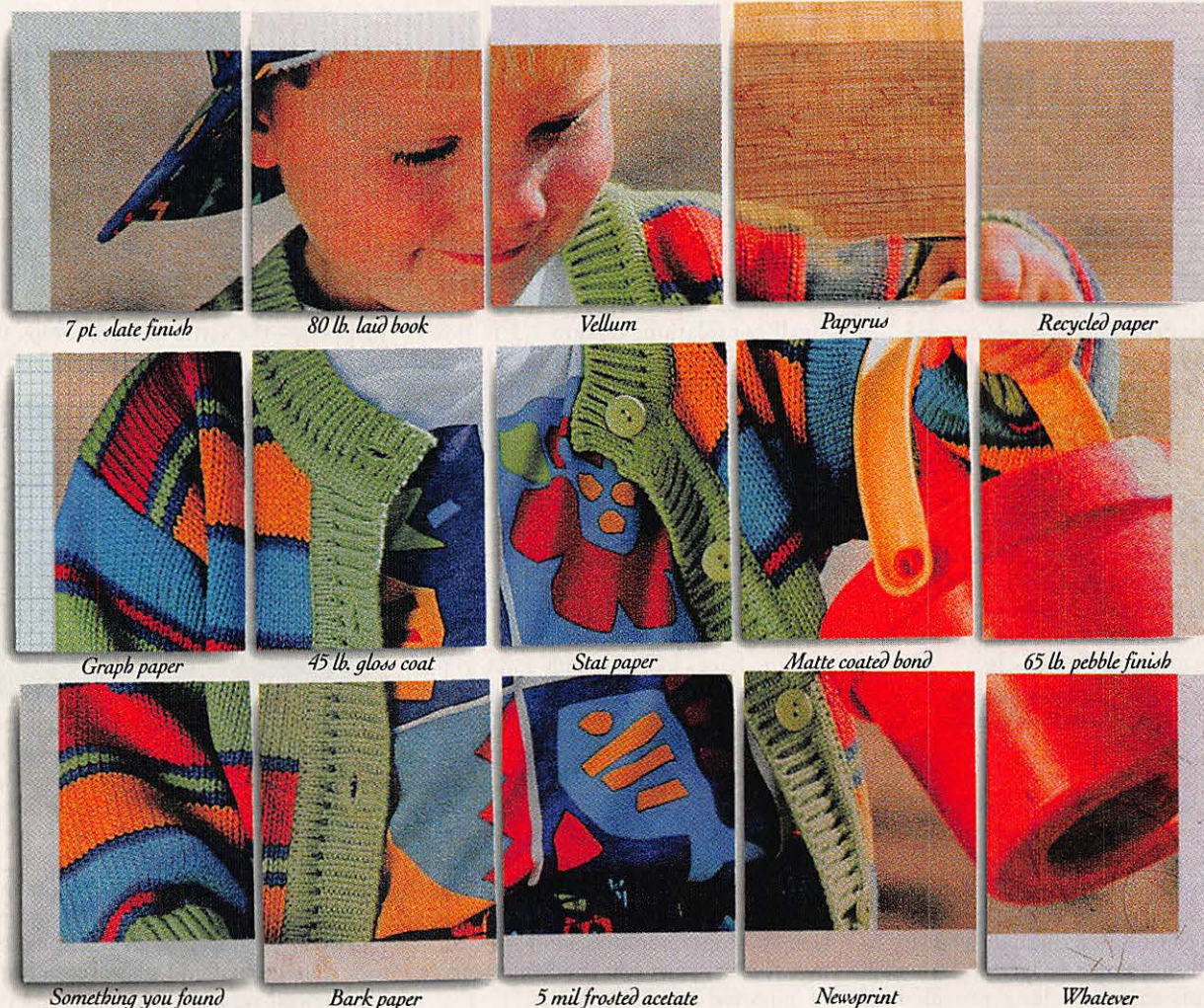


Filter Fish The fish was created by wrapping a skin around several rib shapes created in Adobe Illustrator and imported into StrataVision 3d. The main light source was filtered for a modeled, underwater look. The coral was imported as a PICT image.

you're willing to spend a day or more rendering, you can take advantage of ray tracing, which produces photo-realistic shadows, reflections, and glass refractions. The newest version of Infini-D lets you integrate PICT images into the background of a rendered scene (a capability shared by StrataVision 3d).

Where Infini-D drops the ball is in the lighting department. The program supports only spot and point lights; StrataVision 3d also offers ambient lights and neon effects. But the greater problem is Infini-D's lack of intensity controls. To brighten a scene, you can only change the color of a light, add more lights (which increases the rendering time), or apply the blinding Halogen option to multiply a light's brightness by a factor of five. StrataVision 3d's variable light control makes a heck of a lot more sense and saves time and effort.

In fact, StrataVision 3d is a veritable warehouse of rendering options. In addition to all of Infini-D's capabilities, it also enables you to filter light sources to create cloud and underwater effects (see "Filter Fish"). StrataVision also offers a Raydiosity option that goes beyond ray tracing to account for the impact of reflected light on neighboring objects and inside translucent objects. As if that weren't enough, you can change the focal length of the camera to create heightened-perspective effects and make post-continues



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production adjustments using external Photoshop-compatible filters.

StrataVision 3d's rendering functions are predictably cumbersome. Surface maps always begin at the current view instead of at a prescribed point, which means you have to navigate around and suffer through the subsequent screen redraws. Assigning textures requires a lot of back and forth between two dialog boxes to achieve any serious detail. (A simple flag option would solve this problem.) But all in all, the strength of StrataVision 3d's rendering capabilities excuses these and other minor problems.

3-D Animation

Both Infini-D and StrataVision 3d let you establish key frames in an animated sequence and automatically generate transitional frames between them. You can move objects, lights, and camera angles; morph between objects; and save finished movies in PICS or QuickTime format.

But while the new StrataVision 3d sports a few minor QuickTime enhancements, Infini-D's animation capabilities have been greatly improved in version 2.5.1. The Auto Banking function simulates centrifugal force by progressively tilting an object as it moves around corners. A second function automates camera flybys by aligning the center of a camera to the path of motion, great for tracking a moving object as if the viewer were in hot pursuit. A third function smooths out object movement by accelerating it at the beginning and decelerating at the end. Forgive the hyperbole, but these functions really let novices animate like pros right off the bat.

The 3-D Champ

Infini-D is easier to learn and use than StrataVision 3d, but its capabilities are also more limited. If it weren't for the bloated price, Infini-D would be the ideal entry-level program. It retains only a slight advantage over StrataVision 3d. Furthermore, you can save money by buying Ray Dream Designer for \$349. It lacks animation, but offers good rendering and modeling and some unique advantages. StrataVision 3d, on the other hand, offers more features, but it's sufficiently complex that most burgeoning three-dimensionalists might be better served by Alias Sketch, which sacrifices animation for superior modeling capabilities and faster screen redraw at the same price. Still, if you want modeling, rendering, and animation in one program, Infini-D will get you up and running right away; if you're willing to make a long-term commitment, get StrataVision 3d.

—DEKE MCCLELLAND

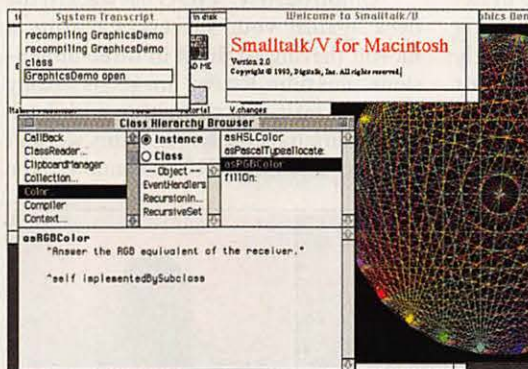
Smalltalk/V for Macintosh 2.0

Object-Oriented Development System

PROS: Fully implements System 7 features without increasing programming complexity; improved multiplatform support; no run-time application royalties. **CONS:** Not well suited for applications targeted at smaller Macs. **COMPANY:** Digitalk (714/513-3000). **LIST PRICE:** \$495.



MOST OF THE MAC INTERFACE, PEOPLE are often surprised to learn, derives from the pioneering development of Smalltalk at Xerox Corporation in Palo Alto, California, 15 years ago. Back when other programmers were entering abstruse mnemonics on character-based terminals, Smalltalk programmers were doing object-oriented programming on video desktops with multiple windows. But Smalltalk was large, slow, and resource-intensive, and instead of eagerly adopting the language, commercial programmers viewed it as a source of cool object-oriented ideas to copy into traditional languages.



Nothing Small about It Digitalk's Smalltalk/V 2.0 does an excellent job of insulating programmers from hardware and systems details, and features the best browsers yet developed for any object-oriented language.

Digitalk's original (1985) Smalltalk/V was an effort to make Smalltalk a commercially useful tool. Digitalk wagered—successfully—that developers would be willing to trade some degree of application performance for development efficiency. With the average Mac's speed and memory now four times or so what they were back then, Smalltalk/V's performance penalty is much diminished. With version 2.0, Smalltalk becomes even more viable for commercial projects.

First, the no-royalties run-time system now includes realistic exception handling, something Smalltalk developers

need in order to generate shrink-wrapped commercial programs instead of in-house custom software. Second, Digitalk has added object libraries that support Apple's Data Access Language, Apple events, and other System 7 innovations. This is significant because much commercial programming involves custom front ends for different databases, a task that's now pretty straightforward in Smalltalk/V. Third, Smalltalk/V's Browser interface has been restructured for faster and easier inspections of classes and methods; you can very nearly assemble a program entirely by cutting and pasting information from the Browser. Finally, Smalltalk/V for the Mac now conforms more closely with the Windows version—another key feature if you're programming for money.

Updating an object-oriented language involves, by definition, an extension of scope rather than an overhaul, since the vendor just expands the class library. In this case, however, Digitalk also rewrote much of Smalltalk for faster performance under System 7; as a result, the language is even more pleasant to use. Digitalk's customer support and documentation continue to set a standard other vendors should emulate.

If you're a professional programmer with an extensive background in C, Smalltalk/V 2.0 would make a worthwhile educational investment—even if you plan to use C++ for applications. That's because Smalltalk is *exclusively* an object-oriented language and because Smalltalk/V includes a superb tutorial. After writing a dozen or so sample Smalltalk programs, you're actually in a better position to appreciate the cleverness of the C++ design than you would be if you made the C-to-C++ transition directly.

Digitalk's run-time system—with a run-time cloner that can also be used to strip out unused objects, methods, and classes from the Smalltalk environment in your finished application—produces fairly compact programs. Since we first looked at Digitalk's Smalltalk/V a few years ago, developers using Digitalk's products have produced a variety of real commercial applications, taking advantage of easy Windows and OS/2 access as well. Now Digitalk is offering an improved product at a good price, and it's the right place to start thinking in objects.

—CHARLES SEITER

Elastic Reality 1.0

QuickTime Morphing and Warping

PROS: Based on a brilliant, simple concept; can create professional-caliber results.

CONS: Difficult to learn; inadequate tech support; sloppy manual; requires 12MB of free RAM. **COMPANY:** ASDG (608/273-6585). **LIST PRICE:** \$349.



MORPHING, OF COURSE, IS THE spectacular special effect in which one image (usually a person) visibly melts into another (usually a different person or, say, an animal). Fans of Michael Jackson videos, *Terminator 2*, or "Quantum Leap" know what I'm talking about. The first Mac program that could create QuickTime-movie morphs was Gryphon Software's Morph; in it, you click to place dots on the screen. These dots specify which points on the first picture (say, the nostrils) correspond to which points (nostrils) on the resulting picture.

Elastic Reality's ingenious twist: instead of placing points, you teach the program what you want morphed by drawing lines on your beginning and ending images. You draw Bézier curves, exactly as you would in Aldus FreeHand or Adobe Illustrator. Assuming that you can, in fact, master the not-very-obvious skill of drawing Bézier curves, this scheme is

far faster and more precise than the point-by-point method. In effect, you're creating an infinite number of reference points for the program instead of a handful.

The real coup, however, is a sophisticated layering feature that permits one portion of your movie image (a growing chin, say) to actually cover up another part of the image (the chin owner's neck and collar). Such overlaps would be impossible in rival program Morph, and double Elastic Reality's flexibility.

The results prove the cleverness of the scheme: with the proper Mac horsepower, it is indeed possible to create astonishing, professional morphs with Elastic Reality. You can morph between moving images (a yawning cat's head becomes your mother-in-law); melt between still images (Rush Limbaugh's portrait becomes Bill Clinton's); and create astounding moving warps (your nose becomes two feet long as you speak). The version of Elastic Reality that runs on Silicon Graphics workstations is already being used to create the special effects in everything from Super Bowl commercials to "Northern Exposure."

Unfortunately, ASDG has stacked the deck against your success. Creating a morph (having to think in three dimensions, plus time, for two images) is already a mental task akin to writing with both hands simultaneously. As if this weren't complex enough, ASDG has endowed the

program with a needlessly convoluted interface. The toolbox—whose icons bear little resemblance to their functions—is modal and tough to get used to. Confusing little windows pop up, seemingly unbidden, from time to time; the FX roll—a prominent interface element—does nothing (it's designed to accommodate future features of the program, says a spokesperson); and important pop-up menus are hidden away in places no Macintosh user would ever think to look.

The manual needs an overhaul—the author continually confuses the control key with the ⌘ key, and errors abound. And the amount left out of the manual would fill another manual; there's no tutorial at all for creating moving morphs, which is probably what you'd buy the program to do. The instructional video is terrific, except that it merely duplicates the tutorials in the manual.

Perhaps most worrisome: the technical-help department (for this very technical-help-intensive software) is one man. This poor fellow serves as the entire support department for both the Macintosh and Silicon Graphics versions of the program. Perhaps because of this impressive work load, his tone—when you can reach him at all—makes it clear that if he had his wish, you and your phone call would just go away.

Alas, learning the program isn't the only problem. Elastic Reality requires serious Mac horsepower, including an absolute minimum of 12 megs of free memory. The company notes that you need more memory for bigger screen sizes and larger movies—80MB for a short feature film, for example. (I tried using virtual memory, but it was so slow that just saving my work took half an hour.) There's an Undo command, but it's grayed out almost all the time. Also, since creating the finished morph movie can take hours, the absolutely critical Preview command is your only chance to see how your work is progressing. Unfortunately, when you ask to see a preview of, say, frame 50, the program instead shows you whatever frame you happened to be viewing before turning on Preview. ASDG calls it a design decision. I call it a bug.

Despite the brilliance of its concept and the stunning output, learning and using Elastic Reality is a struggle. The company president, admitting that ASDG is "somewhat unfamiliar with the Macintosh marketplace," vows that in future versions the program (and its package) will be transformed into a polished, professional piece of work. Now *that* will be an exciting morph to watch.

—DAVID POGUE



Ingredients: 16MB of RAM, one Quadra 800, 18 hours of effort, 13 tech-support calls, two hours of rendering time, 24-bit color, 160 frames, and two relatives.

CSC ChemOffice 2.0

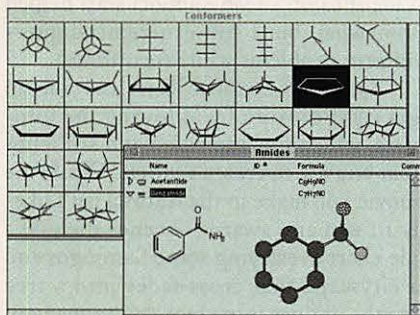
Comprehensive Chemistry Software

PROS: Efficient intermodule integration; links to Word 5; ChemFinder can replace minicomputer software. **CONS:** ChemDraw module less intuitive than ChemIntosh. **COMPANY:** Cambridge Scientific Computing (617/491-6862). **LIST PRICE:** \$995; CSC ChemOffice Plus \$1595.



CSC CHEMOFFICE IS THE MAC EQUIVALENT of software that seven years ago cost roughly \$200,000 and required an equally costly minicomputer. I say this at the outset so that any complaints about ChemOffice can be put in context—complaining about ChemOffice would be like quibbling about carpet color in a new Rolls-Royce you got for \$20.

The basic ChemOffice suite features ChemFinder, a molecular database; ChemDraw, a structure-drawing program; and Chem3D, for creating space-



Words and Pictures The ChemOffice suite links structures to data in other Mac programs; you can associate this structure produced in ChemDraw with a Microsoft Excel data table using ChemFinder.

filling molecular models. The full-color ChemOffice Plus version adds molecular dynamics, energy minimization, and user-definable templates to ChemDraw. The Plus version also extends the range of input/output file types; the standard ChemOffice suite can exchange files with Brookhaven, Cambridge crystal, and MOPAC formats, while Plus can handle Chem Abstracts files, Molecular Design MOLFILES, Biosym and Tripos formats, and export to Beilstein and SMILES formats. A wide range of input/output formats is serious business in chemistry, since the cost of data entry is staggering (perhaps 20 minutes per compound, times the 200,000 to 300,000 compounds in the database of a large company). ChemOffice is thus a fine replacement for a chemist's notebook, but ChemOffice Plus is the correct corporate choice.

Plenty of chemical-drawing, modeling, and database programs have been introduced over the last decade. Cambridge Scientific's accomplishment is the superior integration of chemical-drawing and database information into the rest of the Mac universe. You can create a structure in ChemDraw, using the generous assortment of molecular templates, then link the structure in ChemFinder to data in a Microsoft Excel data table or a FileMaker (or Oracle) database. SoftShell's ChemIntosh is somewhat easier to use than ChemDraw, but ChemDraw (and especially ChemDraw Plus) has all the structure facilities you'll ever need.

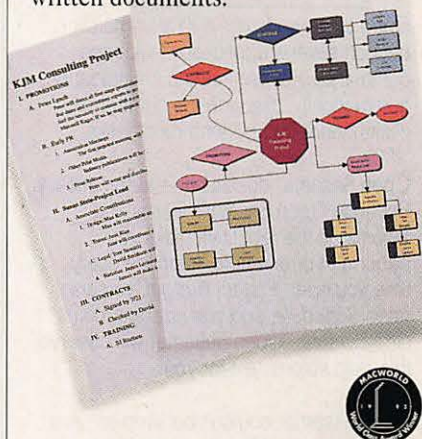
Once you have established a chemical database—typically by importing files and drawing compounds—you can search the database by structures, substructures, and text fields associated with compounds. For generating reports, publish-and-subscribe support in ChemOffice lets you create chemical-drawing windows within word processing documents; you can edit a structure in a live ChemDraw window in a Microsoft Word document, for example. Structures in ChemFinder files or ChemDraw windows can be linked to Chem3D to view wire-frame, ball-and-stick, space-filling, and cylindrical-bonds models—Chem3D lets you generate QuickTime movies of these models (usually to watch the models rotate about different axes). Although Chem3D Plus includes a variation of the MM2 molecular dynamics program, chemists with lots of day-to-day modeling chores may prefer to do modeling in Tripos Associates' Alchemy III (see *Reviews*, *Macworld*, September 1993), which has a more convenient modeling interface. As with ChemDraw, in Chem 3D you can publish modeled structures to other Mac applications; for describing chemical work in progress, ChemOffice is the easiest report generator available for the Mac.

Cambridge Scientific has packed nearly every chemical function you could want into ChemOffice, and has augmented the value of the package by carefully integrating other Macintosh applications. It operates with respectable speed on standard Macs (I recommend a low-end Quadra), and will give minicomputer-based chemical-database packages serious competition when the PowerPC Macs arrive. It's easy to learn, the price is reasonable for the level of functionality, and real chemists answer the phone when you call tech support. ChemOffice is a winner.—CHARLES SEITER

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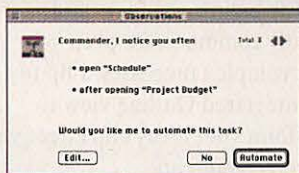
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Reviews

QuickFlix 1.0

QuickTime Moviemaking Application

PROS: Easy to use; good selection of basic effects. **CONS:** Manual could use more detail; recording feature didn't work well with VideoSpigot card. **COMPANY:** VideoFusion (419/891-1090). **LIST PRICE:** \$149.



WHAT THE WORLD NEEDS IS an approachable, affordable QuickTime moviemaking application. If you don't need—or can't afford—a high-end program like Adobe Premiere (\$695), you might well find what you're looking for in VideoFusion's new QuickFlix.

QuickFlix offers a set of basic tools for combining digitized video, animations, still pictures, sound, and text into QuickTime movies. Let's say you want to make a movie of your company's recent junket to Hawaii. You might start out with a slow-motion shot of your boss running down the beach; opening credits roll by while soft Hawaiian music plays in the background. The picture then dissolves into a shot of a meeting; a semi-transparent chart overlays the sales director as she gives her speech, showing pertinent figures as she talks. In the final scene, a colorized sunset fades to black as the narrator summarizes the meeting, and the words *The End* zoom into the frame. You can do all of this (and more) with QuickFlix—and do it pretty painlessly at that.

QuickFlix borrows some of its interface from the company's other product, VideoFusion. But while VideoFusion focuses on special effects for QuickTime movies, QuickFlix lets you make entire movies, which can include colorization, scene transitions, slow or fast motion, chroma-key overlays, and titling.

You build your movies in a storyboard view. You start by dragging a QuickTime movie clip or a PICT-format graphic into one of the squares in the storyboard; then you can drag clips within the storyboard to reorder scenes. To view or edit a movie frame-by-frame, you enter the time-line view, where you can delete frames and add or delete sound; also, you can include the sound track of a video clip, or add your own music, sounds, or narration to a scene. A player view lets you watch a clip, a portion of a movie, or an entire movie; you can also use the player to select just a section of a clip.

Various menu items let you reverse, speed up, or slow down a scene; add tran-

sition effects such as fades, wipes, and zooms; layer one movie clip over another or a movie over a still image; colorize a scene; and apply effects such as negative, posterize, and mosaic. The program's titling feature is versatile, allowing you to set the text's font, weight, size, and color, and add styles such as shadow or outline. You can make titles scroll horizontally or vertically, and you can even combine titles with other effects, using layering to view a scene through a title, or using other effects to zoom or fade a title. (Note: The titling feature is currently incompatible with the Suitcase extension; turn off Suitcase if you want to apply titles.) As you make a movie, you set QuickTime parameters such as frames per second and the amount and type of compression.

With QuickFlix, you can combine existing QuickTime movie clips into a presentation or record your own clips from within the program if you have a video-digitizing board. (The recording function didn't work well with my VideoSpigot card, frequently hanging or quitting the program. The solution suggested by VideoFusion's tech-support staff helped somewhat, but I still experienced intermittent problems while recording.)

QuickFlix is easy to learn, and you can get right to work by following the tutorials, which include video and still clips that you use to create a movie. While the movie you make in the tutorial isn't likely to win any awards—scenes include a pie chart overlaying some flamingos and a cityscape that cross-fades into a tree trunk—it does introduce you to many of the program's features. The QuickFlix manual is adequate, if a little terse.

Although QuickFlix provides a good set of special effects, don't expect the range of effects found in more sophisticated programs such as VideoFusion or Premiere. Missing are fancy effects like pan-zoom-rotate, rotoscope, morph, and mesh warp. But QuickFlix is considerably cheaper than those programs and is not intended to compete with them. If you've used another moviemaking or effects program, you might find fault with some of the QuickFlix effects; when layering clips, for example, I missed the ability to adjust the tolerance of the background color, which allows you to make a background transparent if it's not a uniform color. However, if you're looking for an inexpensive program that gives you access to moviemaking basics, QuickFlix is the way to go. It's a great program for digital-video beginners, people who want to quickly create business presentations, or makers of home movies who can't afford a high-end program.—ERFERT FENTON

Delrina FaxPro for Macintosh 1.0

Fax Software

PROS: Fast, efficient universal fax software; excellent address-book features; good OCR support. **CONS:** Slow printing; interface quirks and minor bugs. **COMPANY:** Delrina Corporation (408/363-2345). **LIST PRICE:** \$129.



DELRINA, WHOSE WINFAXPRO MADE a splash in the Windows market, has now introduced the product to the Macintosh world. The Mac version of FaxPro shares many of the virtues of its Windows counterpart, such as a highly flexible address-book function.

The address book can include individual addresses, or fax lists (each of which can contain a number of addresses). FaxPro can forward your received faxes to a single recipient or a group. You can also assemble a series of fax documents (even from different apps) and send them all at once. Or you can create a fax and broadcast it to one or more mailing lists.

When you first install FaxPro, the software checks your modem for compatibility and then installs several extensions, two desk accessories, and a control panel. The control panel, NoChooser, lets you select the fax driver by holding down a modifier key (the option key is the default). This saves on trips to the Chooser. The fax driver lets you send the fax immediately, defer sending the fax to a specific time, or just save a fax file for later processing.

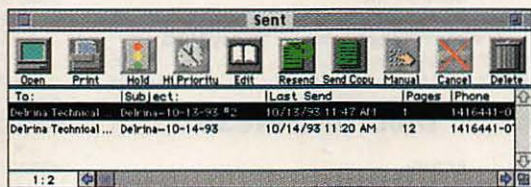
To view and print your fax, you must launch the FaxPro application. The fax file itself is an image that can't be edited, but FaxPro includes an OCR engine licensed from Caere (publisher of OmniPage) that allows you to save your faxed documents in several formats.

Despite a number of powerful and useful features (some, such as its advanced addressing capability, aren't available in other Mac faxing software), the first edition of FaxPro ships with a few bugs and interface quirks. For example, you can print your documents manually, or opt for the AutoPrint function. But this feature is activated by a nonmovable window—while the window is open, you can't do anything else on your Mac. Except for this interface quirk, FaxPro can do its chores in the background. Also when you want to print your fax, be prepared to wait a while. A three-page doc-

ument containing simple text took over an hour to image on an Apple LaserWriter Pro 630. Delrina says it's aware of the bug and expects to correct it soon.

FaxPro supports PostScript fonts (with ATM) and TrueType fonts, but like other fax software, it won't process EPS graphics except as bitmapped PICT representations. Aside from this limitation, fax quality is very good in both directions.

Unlike its competition from Global Village Communication and STF Technologies, FaxPro makes you manually disable the autoreceive fax mode in FaxPro's ModemStatus desk accessory before opening your communications software to log on to your favorite BBS or online service—and you must turn on autoreceive when quitting those programs. Other fax software automatically frees the serial port when you open your com-



Fax-Document Palette Process fax documents via menu commands or by clicking on the clearly labeled icons.

munications program and recaptures it when you quit. At press time, Delrina announced version 1.5 of FaxPro, which will include this feature and add support for Apple's Communications Toolbox.

For maximum OCR accuracy, a fax should be sent in Fine resolution mode, and contain clear, sharp type. FaxPro's OCR accuracy is decent, but the program must treat large documents as individual pages. This can be time-consuming, since the OCR application has to load every time a new page is processed.

The manual that comes with FaxPro is well printed and easy to follow. Technical support is available by fax or phone, and responses are prompt and helpful.

FaxPro isn't fully compatible with Global Village's fax modems (according to the company, version 1.5 will be). Except for FaxPro's sophisticated address-book features, Global Village's own fax software is easier to use, more reliable, and, in general, superior to FaxPro.

But if you don't have a Global Village modem and your present fax software doesn't provide satisfactory address-book features or OCR capability, and you can forgive some of FaxPro's shortcomings until a bug-fix arrives, FaxPro is well worth considering.—GENE STEINBERG

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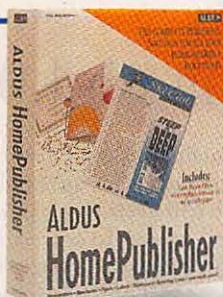
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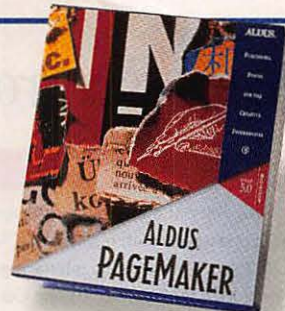


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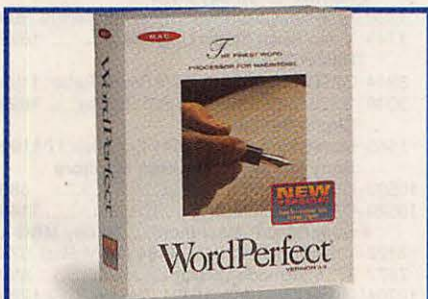
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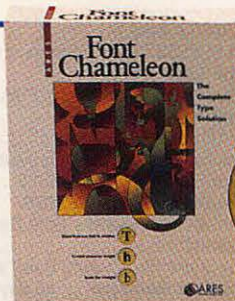
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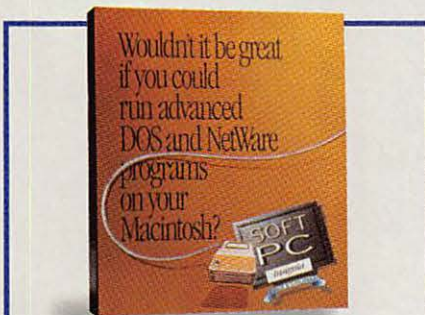
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Avid VideoShop 2.0

QuickTime Video-Editing Program

PROS: Good editing and effects tools; good titling features. **CONS:** Doesn't use SMPTE time code; audio handling needs improvement; some bugs. **COMPANY:** Avid Technology (508/640-6789). **LIST PRICE:** \$499.



AVID VIDEOSHOP 2.0 IS THE LATEST version of the QuickTime movie-editing program originally produced by DiVA Corporation, which was acquired by Avid Technology in 1993. The first version of VideoShop was based on HyperCard, which limited its functionality; version 2.0 is a stand-alone program and is much improved. VideoShop is an easier-to-use alternative to Adobe Premiere 3.0, which is widely used for nonlinear, offline editing. Most people who want to incorporate QuickTime movies into their multimedia productions aren't professional editors and can be overwhelmed by Premiere's complexity and learning curve, not to mention its price. VideoShop is designed for anyone who creates QuickTime movies for CD-ROM projects, for interactive presentations, or for short videotapes.

Launching VideoShop takes you to the VideoShop desktop, which opens with three windows: Volumes, Canvas, and Sequencer. Although the Volumes window resembles the Finder with its familiar file and folder style, only files that can be worked on from within VideoShop—such as QuickTime movies, audio files, and PICT images—are shown. QuickTime video clips are represented as over-size icons, called micons, that show a preview frame of the clip. Selecting the micon animates the clip and shows you the clip's action in thumbnail. Micons are a terrific feature that greatly eases identifying video clips.

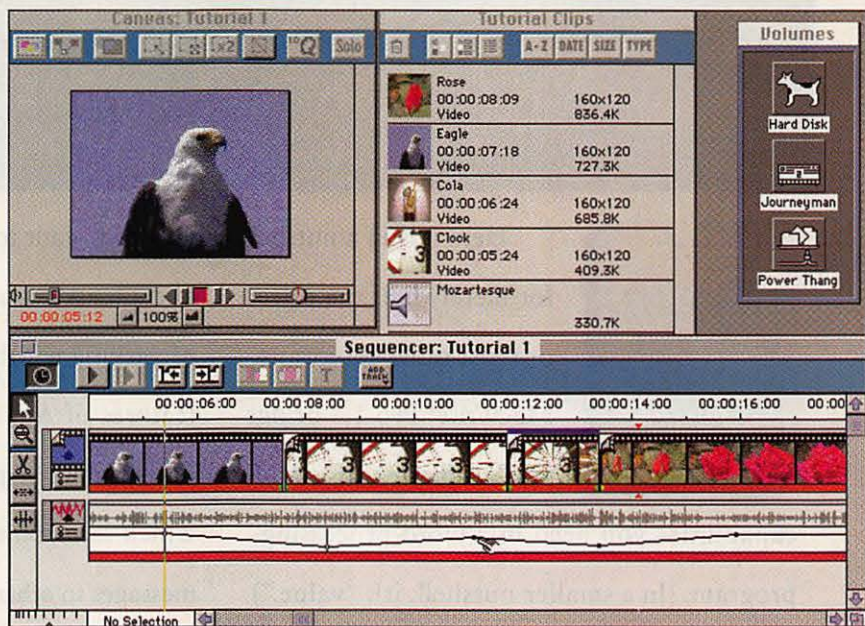
VideoShop is easy to learn. In the Volumes window you locate the video and audio clips that you want to assemble and drag them to the Sequencer, which has separate video and audio tracks. You edit clips in the Sequencer window, which has two modes. Time View, the main editing mode, shows the frames in each clip. In this view you can see every frame of the video sequence; you can adjust the time scale so that you view just one frame out of each full minute of video; or you can set the scale to something between those two extremes. You use Time View

to edit video clips and audio tracks and to apply effects and transitions. Storyboard View shows one frame of each clip, along with the clip's name; you use this mode to assemble many clips into approximate running order. I like Storyboard View because it lets me organize the clips in an editing overview before I do individual frame editing in Time View.

In Time View, the Sequencer window has a time ruler across the top and a toolbox at the left side with selection, magnification, cut, and transition tools. The Sequencer window displays an unlimited number of video and audio tracks, allowing you to work on very complex composited movies. To edit video, you drag micons from their folders into the Sequencer window, usually to Storyboard View. Clicking on a micon with the magnify tool switches you into Time View,

video-preview area on the right, with the standard QuickTime movie controller. A duration bar under the preview area lets you increase or decrease the length of the video sequence to be filtered; this method is much more efficient than programs that make you leave the filter dialog box to change the filter's duration.

After you choose a filter and adjust the duration, clicking on the Build Effect button creates the preview and plays it in the preview area. If you don't like the result, you can immediately build another effect. When you find the right effect, clicking on OK applies the filtered video to your clip. Filtered video is shown in the Sequencer window's Time View with a blue bar above the clip. To remove the filter, you select the blue bar and choose Clear from the Edit menu. If you've applied multiple filters to a clip, only the last filter effect will be deleted. You apply transitions similarly. You can preview different transition types before applying them, and you delete transitions the same



In Sequence The VideoShop desktop shows the Canvas, Clip, Sequencer, and Volumes windows. In the Sequencer, I'm changing the level of the audio track by adding points to the audio rubber band.

where you can select and trim frames and lengthen and shorten clip lengths.

VideoShop comes with more than two dozen filters and 49 types of transition effects. You can apply filters to one, two, or three video tracks at a time. VideoShop can use most Adobe Photoshop-compatible plug-in filters. To add a new filter you simply drag its plug-in file to the VideoShop Plug-Ins folder. You apply a filter to a video using the Apply Filter dialog box. After you select the video for filtering in Time View, the Apply Filter dialog shows you a scrollable list of available filters on the left and a

way you delete filter effects. This non-destructive editing is a good feature, as it lets you make creative changes without laboriously rebuilding video sequences.

VideoShop 2.0 enables you to add motion along a path. In the Canvas window, you can resize a video clip, inset it within another clip, and use the Path Editor to move it around the screen along a user-defined path and to resize the clip as it is moving along the path. You can also save paths for later use.

To access VideoShop's new Titling tool, which lets you insert antialiased

With MacWrite Pro

you can do all the things you can do with competing programs, except for spending a whole lot of money. Yes, this happens to be a wordy headline, but then again, this program's so simple to use, it's easy to get carried away. And when you get carried away, you tend to ramble on with complete disre-



Here it is in a nutshell: for merely half the price of most other programs, MacWrite® Pro 1.5 brings you all the features and capabilities you need in a word processing program. (In a smaller nutshell, it's "value.")

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titles, you add a Text track in the Sequencer window. You can use any font for titles, although PostScript and TrueType fonts work best. You have control over title style and color; and titles can automatically scroll in, out, or through the video frame, as well as in several directions. Adding titles is easy, and you receive instant feedback on your titling decisions in the Canvas window. You can have multiple text tracks, each in its own language; you select which language track you want to use when you play the completed movie.

VideoShop has some limitations, a few annoyances, and some problems worth noting. VideoShop isn't an appropriate editor for QuickTime users whose primary output medium is videotape. VideoShop doesn't use SMPTE time code, and it doesn't create edit decision lists (EDLs), so you can't use VideoShop as an effective offline editor. It also lacks Premiere's videotape device control extensions. The Desktop window doesn't show the length of an audio clip, and VideoShop can't play a regular System 7 Sound file unless you drag the sound into the Sequencer window. You control audio levels by adjusting points in the area below each audio clip, called rubber bands, in the Sequencer. This method is awkward and imprecise when you are working with several audio tracks at one time. Although title control is good, it would be nice to be able to control the kerning between letters in a title.

The program's Read Me file gives a long list of problems in several areas of the program. Most of the problems are cosmetic bugs—for example, in some instances the screen doesn't redraw properly after an operation—but a few are serious. It's to the company's credit that it lists these bugs, with workarounds in most cases, but I can't help wondering if the program was released a bit too early.

VideoShop 2.0's manual is a vast improvement over the previous version, which often seemed as though it were written to confuse rather than inform. The new manual comes with a listing of shortcuts and a quick-reference card, as well as a separate booklet detailing the filter and effect transitions.

Hard-core desktop video mavens who find that VideoShop falls short on the features they need, such as the ability to handle time code and create EDLs, should check out Adobe Premiere. But VideoShop shines in its intuitive, easy-to-use interface. For multimedia producers who use QuickTime as only one part of their presentations, Avid VideoShop 2.0 is a worthy—and less expensive—alternative to Adobe Premiere. —TOM NEGRINO

Expert Pad PI-7000

Personal Digital Assistant

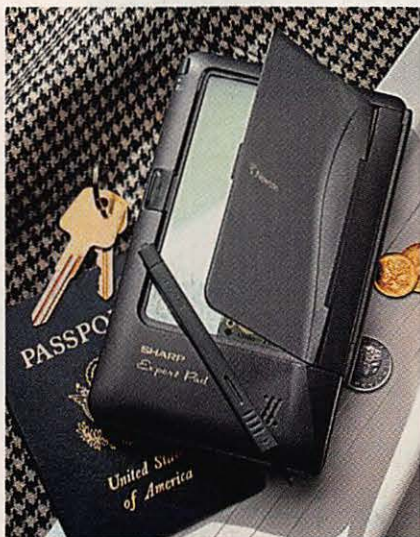
PROS: Same software as a Newton, better industrial design; prompt and intelligent customer support. **CONS:** Message network not yet implemented; same short battery life as Newton.

COMPANY: Sharp Electronics Corporation (800/993-9737). **LIST PRICE:** \$899.



THE RELEASE OF THE NEWTON, after months of noisy publicity, obscured a few manufacturing realities. As a piece of hardware, the Newton is made by Sharp, not Apple. Apple does the software, and Sharp makes the machines.

Sharp's own variant, the PI-7000 (following a naming convention that matches Sharp's Wizard series of personal organizers), was in contrast released rather quietly. This was an eminent demonstration of good sense, given the unfinished state of Newton software for most of 1993. The PI-7000 is now widely avail-



Expert Pad PI-7000

able at electronics retailers but is still fairly underpublicized. The PI-7000 now shipping uses exactly the same software as Apple's Newton (see *Reviews*, *Macworld*, December 1993), although Sharp has plans for possible software differentiation in the future. There are plans for more links to other Sharp products, but the real news will be Sharp's Japanese-language character-recognition software and English/Japanese translation software with speaker output (write in English, hear it in Japanese).

There are some small but significant ways in which the Sharp unit differs from

the Newton. First, Sharp decided to reserve a distinctly better bit of casework for itself. The PI-7000 has a door that covers the writing area, that has the most common points of operational reference printed on its inside panel, and that folds away flat behind the PI-7000 when you're writing (the door has a double hinge). In practice I found the door a convenient place to stick Post-it notes for later transfer to the PI-7000 names database, and Sharp has considered designing a small paper notepad that would fit in the door. The foldaway door seems like a small point, but it means that the PI-7000 doesn't need a separate case to protect its screen—you can put it in a jacket pocket with the screen neatly covered. Furthermore, since no one knows how the touch-sensitive Newton/Sharp screen will hold up after three or four years of steady use, it's only prudent to protect it from accidental pokes, gouges, or abrasion. Next, instead of the Newton pen "holster" on the side of the device, the PI-7000 has a spring-loaded penholder inside the door, which should effectively eliminate in-transit pen loss.

The unit we tested featured system software version 1.04; you get the calendar, name file, notepad, and all the built-in intelligent scheduling functions, handwriting recognition, and Extras found in the Newton. Sharp doesn't provide a Getting Started card, but the PI-7000 runs all the third-party software and communications hardware now appearing on the market for the Newton. Sharp delivers software upgrades through service centers and retailers; if you have the Newton fax modem (Sharp will be offering its own fax modem later), you can download the upgrade from Apple's toll-free Newton number (800/639-8669) or from America Online or CompuServe. Sharp's support (with the same number as for Wizard organizers, 800/526-0264) is prompt and helpful.

If you already have a Sharp Wizard in the 9000 series, you can conveniently transfer data to the PI-7000 via infrared beam. If you don't have an organizer but are thinking of getting a personal digital assistant, the PI-7000 is worth serious consideration. It features the advantages of the Newton in a better industrial design, at a comparable price. Now if Sharp will produce some long-life nickel-metal-hydrate rechargeable batteries for this unit and get a national messaging board operating for fax-modem users, the PDA revolution can begin.

—CHARLES SEITER

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Turing's World 3.0

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COMPANY: CSLI Publications (312/568-1550).

LIST PRICE: \$19.95.



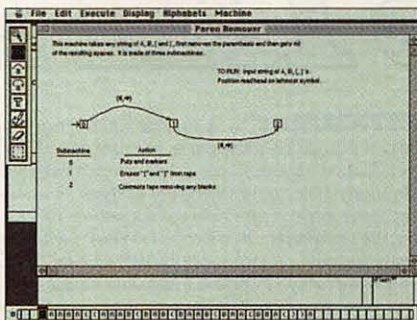
LOST, PERHAPS, IN THE FURIOUS pace of computer development is the fact that computers in most offices aren't used very much in activities dependent on the results of theoretical computer science. From word processing to image manipulation, computers tend to be used simply to represent the paper universe in an easily erasable form. Even so, the computer as a logical device presents us with a variety of primary problems, many unsolved, that form the basis of a vast area of investigation.

One of the first investigators, working before electronic computers, was the English mathematician Alan Turing, who postulated that a simple theoretical device could read marks on a paper tape and change them according to a set of internal rules. He showed that this simple device

could execute any type of search/replace function on the tape, and that this ability was equivalent to carrying out computations of arbitrary complexity. He also showed that some easily defined functions were not "Turing computable" (not computable by any Turing machine). It's remarkable that many of the logical limitations of computing devices were discovered before computers were developed; this exploration was motivated by the startling findings of Kurt Gödel and other mathematicians in the 1930s on the limitations of logical systems.

An understanding of Turing machines is part of a computer-science education, and the publishing project of the Center for the Study of Language and Information (CSLI) at Stanford University has produced this disk and book package as an accompaniment to undergraduate courses. It includes a clear description of Turing machines and their uses in theory development, an assortment of Mac-simulated Turing machines on disk, and a library of tapes upon which the machines operate. The disk and book cover basic problems and the assembly of fancier machines that use basic machines as components, and culminate in examples of non-deterministic Turing machines.

The simulated machines are all simple, you can run them step-by-step to see exactly what's going on, and it's all quite easy to follow. If you follow popular-science writing,



Getting It on Tape This simple Turing machine removes parentheses in math expressions, and is used as a submachine in a more complex Turing machine that parses algebraic expressions.

you'll spot the logical connection between Turing machines and cellular automata and the latest hot topic, artificial life.

Given the almost unbelievable bargain price of this package, I certainly wouldn't object to another version that cost \$29 but included 100 pages or so of additional text material—the package as it stands now is a wonderful accompaniment to coursework but, at 120 pages, is a mite thin for those who simply want to investigate these topics on their own. Even so, it lets you investigate some fundamentals in computing even if you have little computer background and no programming experience.

—CHARLES SEITER

TrakMate

Input Device

PROS: Convenient trackball placement; adjustable height and tracking speed; toll-free technical support. **CONS:** Inflexible ADB setup; forgets custom tracking speed; lacks software.

COMPANY: Key Tronic Corporation (509/928-8000). **LIST PRICE:** \$149.



TRAKMATE IS A TRACKBALL integrated into a wrist pad, an ergonomic design intended to reduce repetitive stress injuries (RSI) such as tendinitis and carpal tunnel syndrome. While TrakMate's unique design may offer some relief from RSI by locating a trackball right in front of your keyboard, it's not for everyone.

The TrakMate matches the Apple Extended Keyboard in style and size, although I don't care for the slick, synthetic feel of the platinum-colored Lycra covering the wrist rest. The TrakMate measures 2.625 inches deep and is as wide as the Apple Extended Keyboard, but extends beyond smaller keyboards. You can adjust its height from 0.75 to 1.125 inches in 0.125-inch increments using two large thumb wheels.

Like most trackballs and mice, the TrakMate uses the Apple Desktop Bus (ADB), so you can plug the device into any unused ADB port. Since the TrakMate lacks a port of its own, it must be the last device in the chain. You can use both the TrakMate and a mouse if you have enough ports, but the hardwired 3-foot cord extending from the right side of the TrakMate may not be long enough to reach the ADB ports on the rear of certain Mac setups.

The trackball measures 34 millimeters in diameter, just slightly larger than the PowerBook 140's trackball. Four buttons surround the trackball. The two large buttons above it perform the same function as the standard mouse button. The smaller lower-left button performs a click-lock, a handy feature that eliminates the need to hold down a button to make multiple selections or drag items. A green LED

indicates when click-lock is engaged.

The right-hand button dynamically changes the resolution of the trackball to 50, 100, 150, 200, or 400 counts per inch (cpi), like the Mouse Tracking setting of the Mouse control panel. Just press the button and the new setting takes effect immediately, indicated by the corresponding LED. Too bad the TrakMate reverts to the default 200 cpi every time you restart.

Fancy features are fine, but comfort is key for input devices. PowerBook users may be disappointed because the buttons on the TrakMate aren't in the same places as on the PowerBook. I experimented with many different control techniques, all of which feel awkward even after several weeks.

Choosing a pointing device ultimately comes down to personal preference. If you are accustomed to a mouse, adjusting to a trackball can be difficult, no matter what its design. Conversely, many people wouldn't trade their trackballs for a rolling rodent under any condition. To make the TrakMate more attractive, Key Tronic should bundle software that reduces repetitive motions by opening menus without a mouse-click, moving the cursor to default buttons automatically, and adding keyboard shortcuts to dialog boxes. Until then, the TrakMate remains an interesting design that may appeal to a relatively small audience.—OWEN W. LINZMEYER



Key Tronic's TrakMate

RICHARD RETHMEYER

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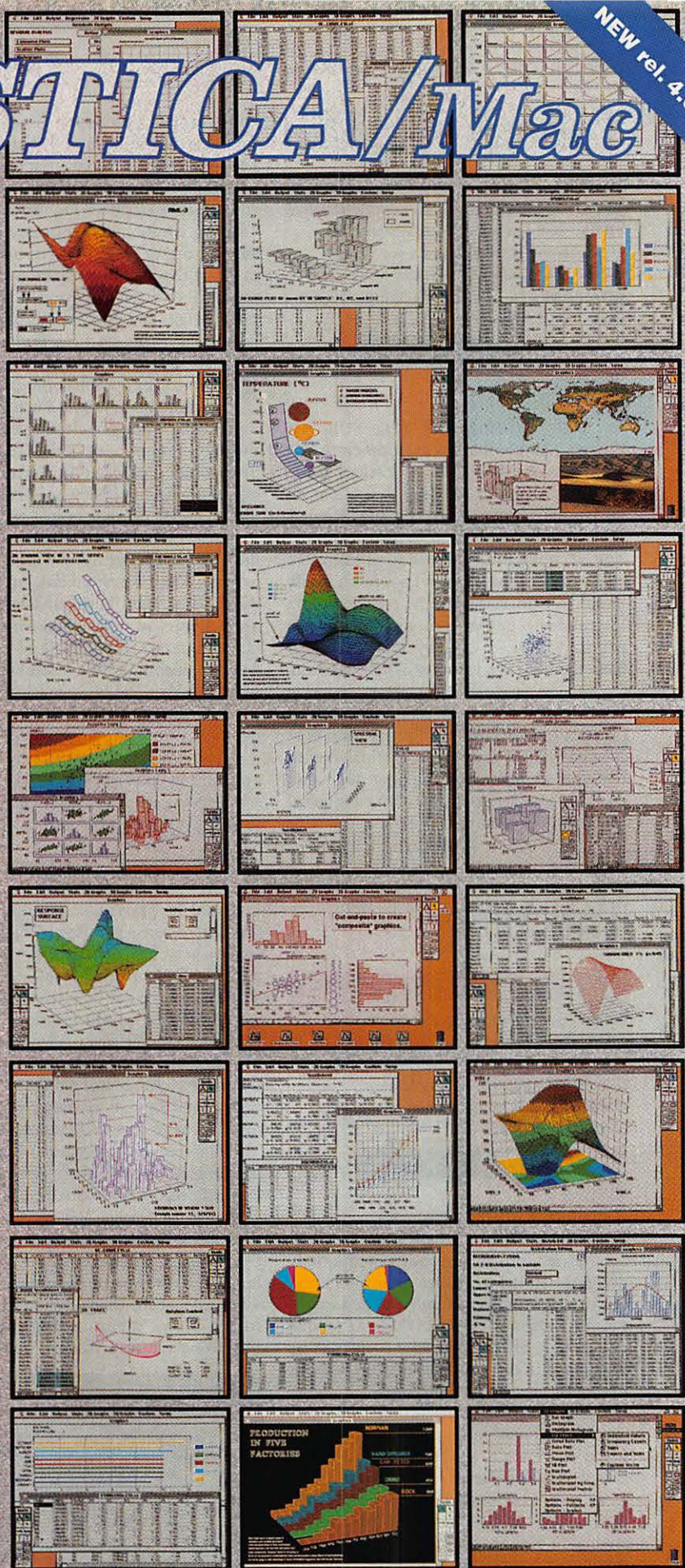
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Silver Cloud 1.2

Network-Management Software

PROS: Can limit Chooser-selectable devices and zones; can use installer and updater over a network. **CONS:** Can easily circumvent zone and device restriction.

COMPANY: AG Group (510/937-7900).

LIST PRICE: 25-user version \$495.



SILVER CLOUD 1.2 IS A MAJOR improvement over Apple's Chooser and is a powerful productivity tool for both administrators and end users.

A network administrator can customize Silver Cloud for a specific user or group of users. Customization options include limiting the number of available devices or zones and restricting access to certain network services such as file servers and printers. Silver Cloud appears as an Apple menu item and requires the same amount of memory (20K) as the Chooser.

Before installing Silver Cloud the network administrator must determine who gets what on the network. As the administrator you can create custom preference files to limit access to department file servers and

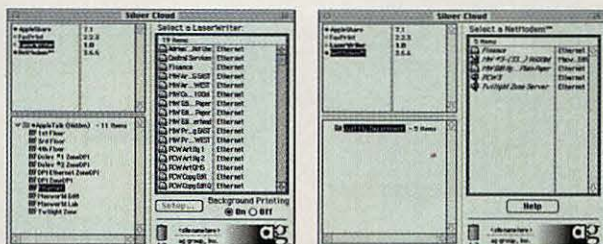
printers. Limiting access makes printer and server switching less time-consuming for the end user. You can also use Silver Cloud to restrict network zones, giving users more freedom to choose devices in their zone.

To create custom preference files, you begin by creating a folder in Silver Cloud (see "Silver Cloud Before and After"); then you select the devices or zones. Silver Cloud includes a Find function so you can quickly locate similarly named devices. Once you locate the desired printers, servers, modems, and so on, just drag each device's icon into the folder. Silver Cloud then makes an alias of each device for future reference. If you then need to restrict a user's access to the rest of the network, simply highlight those zones or devices and choose Hide from the Silver Cloud menu. Choosing Hide only removes the devices from the Silver Cloud window; choosing Show All puts them back in the window. If you want to restrict access to devices, you must lock them after hiding them.

Network administrators should be aware that device and zone hiding is not very secure. End users only need to remove Silver Cloud from their system and reinstall

the Chooser to regain access to the network and all network devices. AG Group does not intend Silver Cloud to be used as a network security device.

Silver Cloud also comes with a network installer and updater, which help network administrators manage networks that are on



Silver Cloud Before and After When you first set up preference files for end users, the Silver Cloud Apple menu item resembles the standard Chooser, displaying all available network devices (left). When customization is finished, Silver Cloud brings you a more concise, less bloated picture of available network peripherals (right).

different floors or in different geographical locations.

If you have a small network with few Chooser devices, you probably don't need Silver Cloud. However, if you are administering a large network and are drowning in a sea of devices and zones, I definitely recommend Silver Cloud.—MATT CLARK

CryptoMactic 1.0.1

Security Software

PROS: Fast Finder-level encryption and decryption of files; effective file removal. **CONS:** Simplest encryption algorithm not quite hacker-proof; some interface quirks. **COMPANY:** Kent Marsh (713/522-5625). **LIST PRICE:** \$99.



THE MAC IS SUCH AN EASY COMPUTER to operate for most of us, we sometimes forget that we might not want some of our work to be readily available to others. Whether it's a company's financial records, a set of personnel files, or even confidential trade information, it's essential to have a quick and easy way to hide those files from unauthorized eyes.

Kent Marsh's CryptoMactic brings file security to the desktop. Like some of the better-known compression programs, CryptoMactic puts an icon (a small circle) on the menu bar. You highlight a file, folder, or disk and select Encrypt or Decrypt either from the pull-down menu or via a keyboard command.

CryptoMactic has five encryption schemes, from the fast LightningCrypt

method to the Triple DES method, which adds two passwords or code keys to the Data Encryption Standard (DES). The Data Encryption Standard is based on the American National Standards Institute (ANSI) encryption scheme.

After selecting an encryption scheme, you enter a password (or even two passwords). Encryption takes from 20 seconds or so up to several minutes, depending on how sophisticated an encryption algorithm you have selected.

You can even save your file in self-decrypting form, which can add 60K to 70K to the file size. Using this option, you can send the file, along with the password, to people who don't have CryptoMactic, and they can then decode it.

CryptoMactic's Incinerate option lets you shred a file so it can't be retrieved. Normally when you delete a file, only the entry on the file directory is removed; the data remains on your hard drive unless new data overwrites it. This means someone could retrieve the data with a file-recovery utility. Incinerate, however, overwrites the file with ones and zeros, or with a more complex coding scheme, so that the original cannot be recovered.

If you forget your password, the CryptoMactic Administrator program allows you to decode your files via a backdoor method. You can remove Administrator for added

file protection, but CryptoMactic's biggest interface quirk rears its ugly head if you do. Without Administrator, when you type your password incorrectly CryptoMactic will attempt to decrypt the file based on the wrong password and will decrypt it incorrectly. To access the file, you must re-encrypt it using the incorrect password (if you can remember it) and then decode it with the correct password. It's very easy to lose a file this way.

Another quirk is less troublesome: after you finish working on a decrypted file, you must manually encrypt it again to keep it secure. CryptoMactic has no automatic encryption option.

While the standard LightningCrypt scheme might provide enough security for many users, it is far from hacker-proof. I sent a file encrypted with this algorithm to two programmers who are not security experts, and they managed to decode the file in short order. The more complex DES formats, however, are harder to reconstruct.

Despite a few shortcomings, CryptoMactic is in most respects easy to use, relatively speedy, and as far as I could determine, it doesn't affect your Mac's performance at all. If you want to effectively protect sensitive files and safely and securely delete outdated ones, this product is worth your consideration.

—GENE STEINBERG

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MacInteriors

Interior Design Software

PROS: Inexpensive; good customer support; object library; cost-tracking feature. **CONS:** Poor documentation; unintuitive features need more dialog boxes; difficult to get precise measurements. **COMPANY:** Microspot USA (408/253-2000). **LIST PRICE:** \$129.



YOU HATE YOUR KITCHEN. YOU'VE got a home-improvement loan and a set of plans, but before you start knocking out walls, you want to know whether you'll like that cabinet over the sink, and if your kitchen table will still fit. Instead of lying awake worrying, you could try MacInteriors, an inexpensive program that lets you visualize your design in three dimensions.

MacInteriors offers five two-dimensional views—a floor plan and four wall views—in which you do the bulk of your work. Using the room-drawing tools and specifying dimensions via dialog boxes, you lay out walls, windows, and floors. Then you furnish the room with objects from libraries (called stationery pads) or use the drawing tools to create your own.

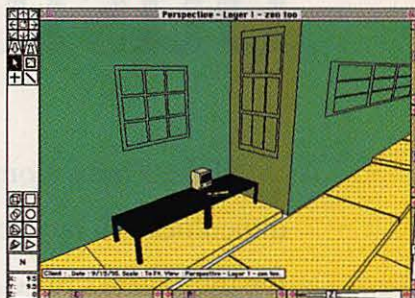
As you work in two dimensions, the program creates a 3-D model of your room. You can easily change your vantage point and field of vision inside the model to explore your new interior. Unlike high-end 3-D CAD and modeling programs, MacInteriors does not aim for photo-realism—it does not simulate light sources, for example, or import textures.

MacInteriors comes with over 100 editable objects such as bookshelves, bidets, and Quadras. You can stretch an end table into a sleeker coffee table, or deform an executive desk into a truly gargantuan power statement. Editable colors and patterns let you roughly simulate surfaces such as wallpaper and flooring. You can create furnishings in the Design mode and add them to the library. You can also assign a dollar value to objects (but not construction costs), and MacInteriors will track your projected expenditures.

MacInteriors is basically a useful program dragged down by its documentation, both on screen and in the manual. Working in three dimensions is not intuitive. If you're not careful, a door that appears to be right where it belongs in plan view might turn out to be 8 feet off the floor in a wall view, and no dialog box cautions you. Getting objects correctly placed is not impossible, just unduly cumbersome. It would be helpful to be able to select an object and

read its dimensions—linear or area—from either an info box or a label. Instead, you must option-click on the ends of each component line and do the math yourself.

Other features that should be intuitive in a program targeted for the casual user aren't. The tutorial is confusing in many places, and although the illustrations are clearly drawn, you have to constantly leaf through to find them. Useful tools, such as



In My 3-D Room I covered my floor with mats filled with a custom pattern. Note that you can't color window frames without filling in the panes.

color editing (not covered in the tutorial), get perfunctory treatment in the manual.

Fortunately, Microspot's customer service is prompt, patient, and helpful, though not toll-free; and in spite of the program's annoyances, MacInteriors is fun to use once you catch on.—STEVEN HANKS

MacGrade 1.5.5

Grade-Book Program

PROS: Easy to use; flexible; clear documentation; money-back guarantee. **CONS:** Lacks features found in other programs, such as seating charts; no network capability. **COMPANY:** CalEd Software (408/6225-6667). **LIST PRICE:** \$85; five-pack \$245.



FEW TEACHERS ENJOY THE TIME-consuming and troublesome process of calculating and recording grades. MacGrade, from CalEd Software, automates the grading process, reducing the tedium and the possibility of computational errors.

Getting started with MacGrade is easy. The manual has clear directions for creating and customizing a new grade-book file. A dialog box prompts you to list categories including subject, period, term, contact phone number, number of assignment categories, and number of students. It also offers choices between weighted or unweighted grades. A second dialog box prompts for assignment category names (such as homework, classwork, quizzes, and tests) and the number of assignments in

each category. Yet another dialog box offers options for customizing grading scales. A Clone command allows you to create new grade-book files by copying the setup information from previous classes.

A grade book opens to a Summary page that displays student names, point totals, letter grades, and the cumulative grades the students have earned in each assignment category. At the top of the window, a control panel (similar to the tool bar in many Microsoft programs) includes a pop-up menu for assignment categories; choosing an assignment category from this menu (or using a keyboard shortcut) transports you to a detailed grade-book page for that category.

You enter grades as you would with a spreadsheet: click on a cell, type the value, and press enter or return. But if you're used to working with a spreadsheet, the next step may be less intuitive: clicking on the equal-sign button in the control panel updates the students' cumulative grades. If you forget this step, the grade totals won't reflect the changes in individual grades.

Between the control panel and the grade-book grid, MacGrade displays class statistics. Buttons in the control panel labeled Student Info and Assignment Info allow you to view additional information about students or assignments. Particularly useful is the Other Information box,

which allows for comments about each assignment or student.

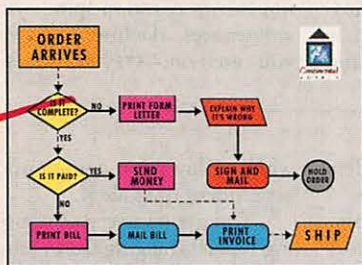
You get a variety of options for printing reports, ranging from standard summary and assignment category grade reports to printouts of students' records, parent letters, proficiency reports, and deficiency reports. Unfortunately, we couldn't find a way to print a complete, detailed grade book except to make separate reports for each assignment category along with a summary report. You can produce grade reports for bulletin board display using confidential student ID numbers. And you can customize letters to parents with personal comments about each student's progress.

We like MacGrade's straightforward, simple user interface and clear documentation. The program has a few noteworthy features not found in competing grade-book programs, but it also lacks some features those programs offer. In particular, the program has no seating charts, dedicated attendance modules, second-language reports, line charts, or network capabilities. (At press time, CalEd Software announced that it would begin shipping an upgrade in mid-December.) We found that when classes exceeded 40 students, the program slowed to a crawl on older, slower Macs. All in all, MacGrade deserves good marks, but there's room for improvement.

—KAY STEVENS AND GEORGE BEEKMAN

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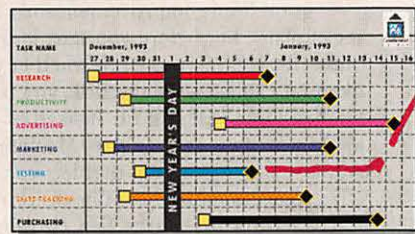
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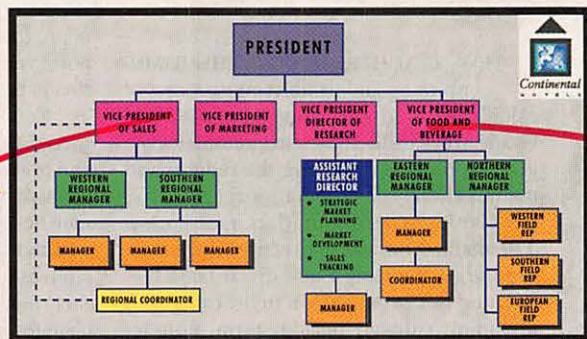
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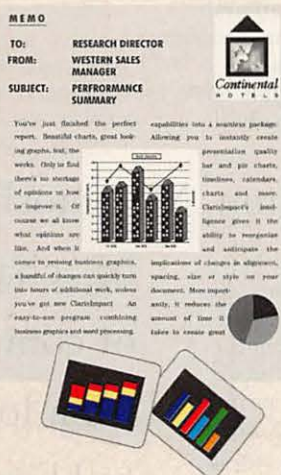
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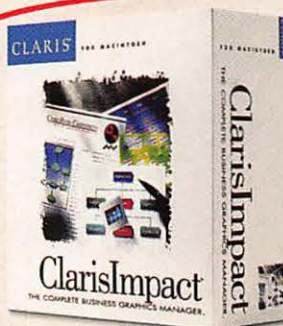
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Macintosh Innovations

The self-contained computer with the smiling face turned a lot of heads when it first appeared 10 years ago, causing some people to scoff and others to lust. The Mac contradicted the expectations people had of a personal computer. Although its fundamental technologies—both

In a decade of evolution, Macintosh technology

hardware and software—were based on research sometimes 30 years old, the Mac's use of these technologies in the service of creating a human-centered computer was a breakthrough. Sure, there were prototypes of such computers at Xerox's Palo Alto Research Center and in other research labs—and there was the Mac's forerunner, Apple's own Lisa. But the former never got anywhere near actual users, and the latter was grossly overpriced and underpowered.

Foremost among these technologies was the Mac's graphical interface—no sets of arcane commands on dark screens here. Second was the Mac's use of a mouse—a pointing device that was available for other PCs but seldom used because few applications demanded it. Finally, there was the appealing package that swam against the tide of personal computer industrial design—a compact, vertically oriented box with a built-in monitor.

That's what people saw on the outside. Inside, the Mac introduced other innovations not apparent to

has changed the face of computing—
from low-cost PCs
to Unix workstations

10
Macworld
INTO THE NEXT DECADE



most users but significant technological: the extensive use of read-only memory (ROM) and the introduction of built-in, plug-and-play networking.

Some innovations were meant to change how people worked with computers. The original Mac keyboard purposefully lacked arrow keys, scrolling keys, and function keys; that way, Apple would ensure that its customers would use the mouse—efficient or not. In the end, that Apple-knows-best strategy went a long way toward making Mac and PC programs look, feel, and operate differently, even if it did sometimes add needless mousing around.

A touch-and-go beginning The Mac's differences attracted attention, and many people went to computer stores to see this new machine. But Macintosh sales were miserable. One reason was price—the Mac's initial \$2495 price was steep for the target users, although not at all bad compared with the Big Business-oriented \$4995 price of a hard-drive-equipped IBM PC XT, or to the \$5469 price of a comparable PC AT released half a year later.

The Mac also omitted some important components. For example, the first Macs could not start up from a hard disk and lacked a fast port to connect to a hard drive. Apple actually expected users to connect their hard drives to the modem port and start the Macs with a floppy.

A more significant reason for the Mac's initially miserable sales was that you couldn't do much with it. Without useful software, the Mac appeared to be little more than a futuristic Etch A Sketch. By 1986, there was a one-year inventory of 512Ks warehoused, and Apple had sold back its warehouse full of 3½-inch drives to Sony because it didn't expect to need any more. "It looked really bleak," says George Crow, a member of the Mac's original development team who is now director of central engineering at Super-Mac Technology. "But overnight it turned." (And Apple was able to get the drives back from Sony when Mac sales finally picked up.)

Saving the Mac What ultimately saved the Mac were three things. First, Microsoft, Lotus Development, and Software Publishing all committed early to develop business software for the Mac. Microsoft's products became the standards, since they were designed for the Mac rather than being cosmetically altered ports of PC applications. In addition, they were exactly the kind of business software that users needed to start justifying enough Mac purchases for users and developers alike to stick with it. Second, desktop publishing gave the Mac its

raison d'être, justifying the huge investment in a Mac and LaserWriter. Third, the addition of desperately needed memory and the SCSI bus in 1986 let the Mac connect reliably to hard drives and other add-ons that enabled the Mac to be used for serious work.

No standing still In the decade since the Mac was introduced, the machine has changed fundamentally. For example, the original Mac was designed with all the hardware that Apple decided people needed. But the Mac learned from the PC: the SE and the II featured expansion slots for any add-on a user might want. (Ironically, PCs got the idea of slots from the Apple II.) Similarly, Macs eventually adopted the multisyncing monitors popular on PCs, freeing users from proprietary video board/monitor combinations.

At the same time, PCs have learned from the Mac: Microsoft Windows is the most obvious example, but there are others. PCs now often have something akin to a Processor Direct Slot (called a local bus), the latest peripheral buses are self-configuring, and 24-bit video boards are now a popular add-on (a far cry from the 4-bit standard of just a few years ago).

Other forces independent of the Mac-PC competition have imposed themselves on both platforms: CD-ROM technology, the expansion of data-communications technology into voice mail and fax, notebook technology, and the ever-more-powerful CPUs that have enabled more sophisticated types of applications.

It's been a fascinating evolution, and it's by no means over.

The Soul of the Mac

The Mac's clearest difference is intangible: how it *feels*. The Mac has its own personality, one derived from a design that emphasizes not programmers' needs but human expectations, through the use of desktop and folder metaphors.

The user interface is the most visible part of the Mac's personality. The Mac was the first computer to bring the graphical approach to a wide audience. But the interface's contribution is not merely the seamless use of graphics. The Mac also pioneered several techniques, including multitasking, stacked windows, icons, aliases, and iconic tools. "Apple did excellent work in terms of how they presented the user interface," says longtime fan and rival Bill Gates, chairman of Microsoft.

The one flaw with a wholly metaphoric system is that it penalizes people who know exactly what they want to accomplish. That's why Microsoft added a slew of keyboard shortcuts to its applications. But to the original Mac developers, a keyboard command was a terrible

thing; they wanted to convert users fully to the metaphoric approach.

The power of events The metaphoric approach is event-driven. The Mac waits for something to happen, and then it reacts, a key element to making the Mac truly intuitive. For example, if the user moves the mouse so the pointer is over a menu, the menu drops down. But if the user moves the pointer into a text block, the pointer changes to the I-beam text tool. This approach made the Mac react to users in a sequence that made sense for the user.

That was a radical idea in the early 1980s, when computers and software relied heavily on user-toggled modes—operating states in which the range of tasks you could perform was constrained. "The Mac showed that with a different quality in the user interface, you could actually open computing to many other people," says Philippe Kahn, CEO of Borland International, a major developer of PC software.

But for developers in 1984, this was a tricky concept. They had to change their programming methods to accommodate an almost endless set of possible user interactions. That meant it took longer to develop Mac applications than expected—and the Mac in turn came close to dying for lack of software.

The Mac's radical approach to the interface has changed the look and feel of applications on all computers. Today, even DOS programs sport pull-down menus and dialog boxes. "Excel was a Mac product, and it set standards for spreadsheets that changed the whole spreadsheet category," says Gordon Eubanks, CEO of Symantec, which develops programming tools for Macs and PCs. "MacWrite changed the whole way we looked at word processing. FileMaker set the standard for a lot of the graphical databases. The Mac not only developed a paradigm for the [operating] environment, but most applications owe their heritage to the Mac," he adds.

Building blocks Another factor in its operating system design contributed to the classic Mac personality: its modularity. Apple engineers exploited this feature to the fullest, writing modules that governed basic interactions.

Some of the modules are internal to the system. QuickDraw is the best known of these toolbox components; all programs use it to handle what they display, which ensures consistency in both look and execution and eliminates the need for developers to write code that handles screen displays. The Mac has dozens of such toolbox managers, most stored in ROM. The concept was hardly revolu-

Transforming the Mac Interface

Just imagine speaking to your computer—requesting “the latest on our new products”—and the computer then finding everything, including new information from a network you did not know about. You can read and edit all documents instantly, even though they were created on different computer platforms using software you do not have. This experience should be typical by the year 2000.

Document-based computing

Today's massive applications, such as word processors, create documents that typically can be read and edited only by that application. And word processors cannot edit text embedded in, say, a business chart.

A document-oriented interface (DOI) would do away with applications as we now know them; instead you'd simply open documents. Whenever you selected an object—textual, tabular, or graphical—the appropriate tools for manipulating that object would pop into view. A text-editing tool would operate on any text—from text in a book to the legend on a business chart to the display type of an advertisement. A page-layout tool could specialize at what it does best and stop trying to

course, if the tools and objects in all documents were compatible—a formidable challenge. But we're already enduring the chaos of massive, multipurpose, cross-platform applications. Smaller DOI tools should make the job far easier. A DOI future seems certain, in part, because Apple and Microsoft support it in recent system-software developments, such as Apple's OpenDoc and Microsoft's Object Linking and Embedding (OLE). A form of the DOI is already built into the Newton. And a DOI will figure prominently in future Mac and Windows operating systems.

Freedom of speech The second most critical interface development between now and the year 2000 should be speech recognition and synthesis. Modest speech functions are already available on the AV Macs; you can call your computer from an ordinary voice phone, for example, and tell it to read your E-mail. And people with hand injuries can use voice commands to handle routine or repetitive tasks.

But for most of us, why bother with voice commands? The visual WYSIWYG interface is “centered around the idea of directly affecting objects on screen,” says Kai-Fu Lee, manager of the interactive media group in the Apple Advanced Technology Group. “If you already see the object, why talk about it?”

Speech is best for “indirect manipulation—for objects not on the screen or in a menu,” says Lee. “If you have 1000 files, it

future software should know that a 1998 document that refers to “next year's projected earnings” is relevant and that a memo describing a “fussbudget” is not.

A speech interface and software intelligence would make a computer less a tool and more an assistant. You could instruct it to “write a thank-you note to John,” says Lee. “The computer might ask a couple of questions—which John? Short or long letter?—and then write the letter.” Right now, this would mean a form letter. For a more personal touch, a computer would have to understand semantic context.

Until that great challenge is conquered, computers will have difficulty doing the one thing people want most from a speech interface: transcription—conversion of continuous speech to text. Lee believes that true transcription is more than 20 years off. But Elton Sherwin, a manager of IBM's speech-recognition efforts, predicts usable transcription in 2 to 4 years. Such recognition would not rely on full semantic analysis but on a simpler statistical analysis of word context. The results may not be perfect, but this method would be faster than entering everything via a keyboard.

Mightier than the sword?

Handwriting recognition will also come to the fore in the next few years, but it will be a supporting player in the interface of the near future. “We will never have perfect handwriting recognition,” says Apple's Norman. “People can read handwriting reasonably well [only] when they know what it is about. Pens do have a place for form filling, short writing, drawing, and selection.”

Ironically, the Mac's best known and loved feature—its human interface—has changed little in ten years. It's gotten stale. Fortunately handwriting, voice recognition, and a DOI will soon begin to transform the way we use the Macintosh. Ultimately, we'll see computers that work more like people. That will be a big step toward fulfilling the Mac's original promise.—Cary Lu



APPLE'S KAI-FU LEE: IF YOU ALREADY SEE THE OBJECT, WHY TALK ABOUT IT?

incorporate a text editor.

This scenario would dramatically alter the way we purchase software. Today, to wrap text around a picture, you usually need a full graphics application. “In the future we will go to the software store and say ‘I need a [universal] wraparound text tool,’” says Donald Norman, an Apple fellow and author of *Things that Make Us Smart* (Addison-Wesley, 1993).

This would only work, of

takes too long to scroll through them with a mouse. Instead, you delegate the action to the computer.” This form of speech interface requires not only speech recognition, but the kind of software intelligence that the Newton offers a glimpse of.

What might you ask for from an intelligent system? Something like “find everything dealing with the 1999 budget.” Today's software can find documents with keywords (*budget*, 1999), but

Macintosh Milestones: 1983–1994

1983 LISA SHIPS AND IS AN EXPENSIVE DUD



◆ Apple introduces Lisa computer. Later renames it Macintosh XL. Discontinues it in March 1985.



◆ John Sculley, formerly president of Pepsi-Co, is named Apple's president and CEO.

◆ IBM announces PCjr, which ends up a laughingstock. First crack appears in IBM's facade of invincibility.

◆ Microsoft Windows is announced.



◆ Apple enters Fortune 500 at number 411.

◆ IBM has 1 million PC users.

1984 APPLE RELEASES THE MAC, DECLARES WAR ON IBM



◆ Macintosh 512K is introduced in September, solving Mac's memory deficit.

◆ IBM ships the PC AT.

◆ Hewlett-Packard LaserJet is released.

◆ Philips announces first CD-ROM players for PC makers (under \$1000).



◆ Apple launches Mac with landmark "1984" commercial.

◆ Drive makers announce 3.5-inch floppy disk standard.

Art credits (left to right): Apple Computer, Rob Dudley, Robert Holmgren, Apple Computer, Apple Computer, Rob Dudley, Apple Computer, Reuters/Bettman. Background image (left side) courtesy of

tionary—programmers have long known the benefits of standard code libraries—but applying it to the operating system and user interface took the concept to a new level.

Another payoff of the Mac OS's modularity is the ability to add functionality without rewriting the entire operating system. That's basically what extensions like QuickTime and Data Access Language are. A related benefit is that functions can be given to just those who need them, without burdening every Macintosh owner.

But the modular design can also lead to confusion: you may lack an operating-system component, but not realize its absence until you need it—for example, do you know whether you have the QuickTime extension loaded?

Interface evolution The Mac interface in many respects has changed little—it still has the same basic look and feel. But that similarity is misleading, argues Joy Mountford, director of interface development at Apple's Advanced Technology Group. "At the end of 1986, there was no HyperCard, no video, no sound, and [the Mac] was black-and-white. When I came to Apple [that year], people asked 'Why would you want a bigger screen?'" she says. No longer. Other changes include the use of multitasking (through the MultiFinder) and the use of hierarchical menus.

Apple expects improvements in its Chooser interface in the near term: "The Chooser is one of the interfaces that needs the most evolution," Mountford says. And over the long term: "I don't think a single metaphor works for all

tasks. The machine should act differently for different people," she says, so the Mac interface should be customizable.

Many Mac developers think that the Mac's interface is long overdue for a makeover. Some, like SuperMac's director of strategic relations, Tom Reilly, argue that there is now a strong reason for Apple to change it: the "frightening" similarity to the Mac's interface of the forthcoming Windows 4.0. But don't expect Apple to make merely cosmetic changes in reaction to Windows 4.0. "There is simply less value in differentiating the user interface," says Chris Espinosa, a member of the original Mac's interface team who now directs strategy for system-development tools at the AppleSoft Division. Ease of use is not as critical a selling point now as it was in 1984, he says, since all computer interfaces have greatly improved.

Carving the soul in stone Perhaps the most important hardware innovation was extensive use of ROM. By casting the Mac's user-interface elements in silicon and then preaching their benefits to developers, Apple ensured that the Mac would operate more consistently across programs than other computers.

Developers who used Apple's code in ROM could use all of the Mac's RAM for their applications' core features. Developers who bucked Apple's standards had to pay the price of using that precious RAM for nonessential code. "It put a pressure not to make all applications gratuitously different," says Bill Atkinson, a member of the original Mac development team whose credits include MacPaint and HyperCard; he now is a principal at Gen-

eral Magic, which is developing "intelligent" personal assistants.

The advantages of ROM—control and consistency—let the Macintosh leverage its taxed resources to get the most out of them. By contrast, PCs put only the rudimentary standards in ROM (which they call a BIOS for Basic Input/Output System), which meant developers had to create their own approaches, resulting in the confusing mix of methods PC users deal with daily.

Another hardware innovation was the use of application-specific integrated circuits (ASICs), which let Apple combine several capabilities onto a single chip and thus reduce manufacturing costs, system-board size, and power consumption. (At one point, Apple suggested leaving the Mac on as a night-light because it used so little power!)

The End of the Monolithic Mac

The first Macs were designed to be all the computer a user would need, so each model through the IIx was designed practically from scratch. The development team's original philosophy was that the Mac design should work for all users. "We had the vision that you shouldn't have to add to the Mac to make it useful," says SuperMac's Crow. But there was also an emotional undercurrent to that philosophy: "A lot of the early stuff came from a reaction to how out of control the original Apple II architecture was," says Apple's Espinosa. That led to much-criticized decisions such as not allowing memory upgrades or a hard-drive port.

"The lack of SCSI was simply a mistake," Crow says. So was the lack of mem-

1985 DESKTOP PUBLISHING IS BORN

◆ Windows finally ships, three years after being announced.

◆ Sony introduces 1.4MB floppies.

◆ Microsoft ships Excel for Mac.



◆ Manhattan Graphics ships ReadySetGo, first DTP program for Mac. Aldus releases PageMaker, which transforms publishing.

◆ AppleLink goes into service.

◆ Apple introduces LaserWriter printer and AppleTalk Personal Network.

◆ NEC releases first multisyncing monitor.

◆ 3Com announces Ethernet server for Macs.



1986 MACINTOSH BECOMES A FINANCIAL SUCCESS

◆ DOS portables under 12 pounds with video-out start to appear.

◆ Macintosh Plus is introduced; SCSI is introduced.

漢字

◆ Microsoft ships Excel for Windows.

◆ Apple introduces KanjiTalk version of Macintosh Operating System.

◆ Compaq ships first 386-based PC, ending IBM's role as standards-setter.

◆ Attain releases FileMaker.

◆ Aldus, Microsoft, and others announce TIFF standard.

◆ Bill Gates predicts new type of application called multimedia.



◆ Steve Jobs founds Next Inc.

Apple Computer.

Mac on the Go

The clamor in the Mac community for a notebook can't be overstated. In 1984, you could get a DOS notebook: the Radio Shack Model 100 cost only \$799, but its few lines of text were hardly



Hoping to lay to rest the specter of the Mac Portable fiasco two years earlier, Apple delivered lightweight computers with built-in trackballs, wrist rests offering ergonomic advantages, and backlit screens capable of displaying a graphical interface. And the PowerBooks retained the sophisticated power management that the Portable had introduced.

"Nobody talked about ergonomics before in notebooks," says Bruce Gee, product manager for the first PowerBooks. Equally important for mobile computing but less heralded was AppleTalk Remote Access, which let roving computers plug into a Mac network from anywhere in the world with decent phone lines. PC vendors are still trying to implement something similar that works across the array of PC networks.

on PC notebooks. IBM released its ThinkPad notebook in 1993 with a radical pointer device that wowed users so much that it knocked the PowerBook out of the number one spot in sales.

And the notebook makers kept innovating. They produced color displays, subnotebooks, and docking stations (but without the file-saving precautions in Apple's DuoDock) as much as two years before the Mac equivalents. Some notebooks had floppy drives that popped out to make room for an extra battery. Others converted to pen computers or had replaceable screens. Almost all had fast 486 CPUs.

Meanwhile, Apple fixed a few of the obvious omissions, like video ports and lack of color displays, but ignored others, like user-upgradable RAM. The once-

A DECADE'S DIFFERENCE: TODAY'S POWERBOOK 165 AND THE RADIO SHACK MODEL 100 FROM 1984

appropriate for more than the most basic text editing. By the end of 1989, true notebooks—with large screens and hard drives—were a reality for PC users. Still no Mac units.

In October 1991, Apple fulfilled the dreams of many users by introducing the PowerBooks.

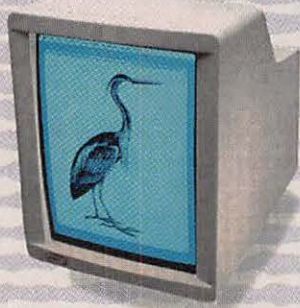
The trendsetting PowerBooks had a major effect—on PC notebook makers. Intel soon introduced its 386SL and later 486SL CPUs, which incorporated power management. Vendors added additional power management. Tiny, built-in trackballs—in all sorts of places—sprouted like mushrooms

innovative PowerBooks now look like many other notebooks.

When Motorola delivers the PowerPC 603 CPU, Apple should have a fast, low-power CPU that makes PowerBooks at least match 486 notebooks in performance. As for other innovations, Apple is keeping quiet.—Galen Gruman

Macintosh Milestones: 1983–1994 (continued)

1987 MAC EXPANDABILITY IS BORN



◆ Radius ships first Full Page Display.

◆ Commodore and Atari enter PC clone market, leaving Apple the only major holdout.

◆ Forethought ships PowerPoint.

◆ HyperCard and MultiFinder are introduced.

◆ First active matrix technology LCD panels appear.

◆ Aldus releases PageMaker for Windows.



◆ Macintosh II introduced: first use of 020 and expansion slots.

1988 MAC ARTISTRY COMES OF AGE



◆ Adobe ships Illustrator 88; Aldus releases FreeHand. Programs transform computer illustration.

◆ NEC Ultralite is first subnotebook (4.4 lbs.); includes pen and handwriting recognition.

◆ Novell ships NetWare for Mac.

◆ Multisync monitors become common on PCs.

◆ ISDN demoed.

◆ Apple files suit against Microsoft and Hewlett-Packard to protect its Macintosh interface look and feel. It loses in August 1993.



◆ Apple reports first billion-dollar quarter in its history.

◆ Kinetics ships FastPath 4 LocalTalk-Ethernet gateway; first Mac "enterprise" connection.

Art credits (left to right): Luis Delgado, Apple Computer, Rob Dudley, NavaSwan/FPG, Apple Computer, Rob Dudley, Will Mosgrove/Apple Computer, Luis Delgado. Background image (right side) Bill

ory expansion. "The engineers fought really hard" to keep the seven-pin connector in the 128K Mac that allowed memory upgrades to 512K, recalls Doug Gilbert, a cofounder of Levco, which was one of the first companies to sell such upgrades over Apple's objections. But the prevailing view—made into dogma by Steve Jobs—was that the original Mac should be an all-you-need appliance.

Opening the Mac That dogma is all but gone at Apple today. Apple now sells several types of Macs—with different mixes of hardware and System components—designed for different types of users. The first crack in the monolithic view was the 1987 introduction of the Mac II—the first open Mac—and the SE. Apple was both sanctioning expansion and recognizing different types of customers (corporate versus home users). Apple cemented this change in 1990 with the introduction of the LC and the Classic. "We don't have a one-size-fits-all approach any more," says Brodie Keast, Apple's director of product marketing.

What Apple eventually learned to do, says Espinosa, was offer "choice with simplicity." He cites the Mac II's use of NuBus, which required no user configuration of jumpers and switches as PC expansion buses did. The first Macs offered no choice; PCs offered too much choice. Neither approach was correct, he says.

Quickening the pace of change Although Apple had developed different models for different markets, the pace of technological change remained slow. For example, Macs like the 1989 IIfx had incredible life spans: three years—compared with the general PC world, where

change was taken for granted.

But in 1993, Apple adopted the fast pace of the PC world. In that year alone Apple introduced seven 040-based models offering different levels of performance. Finally, Mac owners could get incremental improvements in speed rather than wait until the next leap in performance, as had been true when, say, the II and the IIfx came out. Now, Macs are competitive with PCs in terms of both performance and price.

For Apple to do that, it had to change its product-design approach. Gone was the handcrafted approach that Apple cofounder Steve Jobs insisted on in the Mac's early days, when even the internal components that only the rare technician would ever see were designed to look good. In 1992 Apple began systematically reusing one basic design—not just components—for many models. For example, the Centris 650, Quadra 800, and Quadra 650 share the same basic design; likewise, the LC III, LC 520, Performa 475, Performa 550, and Quadra 605 spring from one design.

A positive result for Apple is that this approach "makes you think about more than one generation of the product," says Steve Manser, Apple's director of modular Macintosh products. That reduces long-term costs and allows long-range planning to accommodate technologies still under development.

Apple also started relying on partners for design and manufacturing: Sony for the PowerBook 100, SuperMac for the MiniDock, Sharp for the Newton, Insignia Solutions for the Quadra 610's PC coprocessor board software, and

Logitech for the PowerBook's built-in trackball.

Losing the performance edge The demands of graphical processing—calculating each of the 196,608 bits on the screen, drawing proportional fonts on the fly, and the like—were more than any popular computer in the early 1980s was designed to handle. In that light, Apple's adoption of the Motorola 68000 CPU may seem today to have been risky, given the predominance of Intel CPUs in PCs. But in the early 1980s, the 68000 was a more advanced CPU than Intel's 8088 or 8086, and developers say it was easier to program for. Apple engineers also made sure the Mac used the CPU in ways to avoid bottlenecks or slowdowns. For example, the sound rate was set to match the video display rate, so the CPU could process sound in the time between screen redraws.

But Macintosh performance soon fell behind that of PCs, for three reasons. The first is that Intel quickly caught up with Motorola. The second is that PC makers quickly took advantage of the improvements. For example, Motorola's 68020 and Intel's 80286 were both announced at about the same time, but the first 286-based PCs (IBM's PC AT) predated the first 020-based Mac (the Mac II) by nearly three years. Since then, it has been no contest. When 030s were state-of-the-art in Macs in 1989, PCs were starting to use the much more powerful 486. Even with Apple's fine-tuned engineering, Macs simply lacked the power of a PC. The third reason Mac performance suffered is that "System 7 overloaded the processor," says SuperMac's Crow. Any-



◆ **Apple announces Macintosh Portable and Macintosh IIfx.**

◆ First 486-based PCs and real PC notebooks ship.

◆ **Apple introduces 32-bit QuickDraw.**

◆ Adobe agrees to share PostScript hinting secrets.

◆ **Apple announces Apple SuperDrive.**

◆ Microsoft Windows sales match Mac sales.



◆ **Adobe announces Adobe Type Manager.**



◆ Michael Spindler becomes president of Apple. He becomes CEO three years later, replacing John Sculley.

◆ **Apple rolls out Macintosh Classic and Macintosh LC.**

◆ Apple extends warranty for U.S. hardware products to one year.

◆ **Microsoft Windows 3.0 is released: first challenge to Mac quality standard.**

◆ TrueType is released.

◆ Adobe Systems releases Photoshop.



◆ **Radius introduces Pivot monitor.**

Gates courtesy Microsoft, John Sculley courtesy Tom Zimmeroff/Apple Computer.

one who has used System 6 knows that moving to System 7 (released in 1991) means buying more RAM and seeing less speed. Only recently did Apple switch to a CPU—the 040—that could handle System 7.

A computer's overall performance is more than just its CPU's raw speed, and Apple argues that, from the holistic view, Macintosh performance has been competitive all along. Examples include "the high performance for graphics, the built-in Ethernet for most business Macs, and the high performance of mass storage, such as the double-speed CD-ROM drives," says Apple's Keast. But that argument has been hard to make to performance-oriented buyers who equate speed with productivity.

The Publishing Revolution

Many key contributions in the Macintosh world came from independent developers. And desktop publishing, more than any other technology, has defined the Mac's reputation and many of its capabilities today.

The typographic edge A key component of publishing is typography, and people with graphic art experience felt their skin tingle the first time they saw menus named Font, Style, and Size. Not only did the Mac provide typographic variety, its screen rendered those fonts much as they would appear when printed—WYSIWYG was born. All but the most expensive dedicated typesetting systems available when the Mac first came out lacked this degree of interactivity and screen-to-paper fidelity. What made this possible was the Mac's use of a bitmapped

graphics display and the QuickDraw library of graphics routines that did the graphical processing.

The Mac may have been typographically aware from day one, but nearly two years elapsed before the key pieces of the publishing puzzle fell into place. One important piece came in 1985, when Apple shipped its LaserWriter printer. Built around a new print mechanism designed by Canon, and driven by a new printing protocol from Adobe called PostScript, the LaserWriter was the first relatively inexpensive (\$6995) laser printer to provide a wide variety of type styles and the ability to print a full page of graphics at 300 dots per inch.

Non-PostScript devices (including the Hewlett-Packard LaserJet and the Mac itself) used fixed-size, or bitmapped, fonts, which required a separate, memory-consuming description for each desired size. One breakthrough that accompanied PostScript was the outline font—a mathematical description that a printer could use to produce text in any size and orientation. Another breakthrough was the development of techniques—called *hints*—that let a relatively low-resolution device such as a laser printer accurately render serifs, stems, and other character components at any type size or orientation.

But there was a problem: PostScript needed far more memory than the 128K and 512K Macs provided. According to John Warnock, cofounder of Adobe Systems and cocreator of PostScript, "Jobs said, 'What if we put more memory in the printer and put a computer in the printer and put [PostScript] into ROM?'

That scared the hell out of us, but we pursued it." When it shipped, the LaserWriter contained 1.5MB of RAM and 512K of ROM containing PostScript, all driven by a 68000-based computer.

As it turned out, this approach had so many strong points, including less processing overhead in the host computer and much easier networking, that the vast majority of today's PostScript printers still work exactly the same way.

Because PostScript licenses from Adobe were expensive, PostScript clones started to appear in 1989. At the time, they usually fell short in terms of compatibility, performance, or both; but their existence was evidence of the smoldering resentment many companies—including Apple, whose printing fortunes were tied to PostScript—had against Adobe.

Apple was also developing new output devices that would be driven by QuickDraw instead of PostScript, including its first (and infamous) fax modem as well as the LaserWriter IIS laser printer. Because the Mac's system software still relied on fixed-size fonts, these add-ons lacked PostScript's any-size-you-want flexibility. It became obvious that QuickDraw needed outline fonts of its own, and since Adobe kept its Type 1 PostScript technology a secret, Apple decided to look elsewhere.

The result was TrueType, which Microsoft and Apple codeveloped and released in early 1990. On Windows, TrueType has become the standard font technology, but on the Mac it has been less successful, largely because PostScript printers are so well entrenched. However, the emergence of TrueType did force

Macintosh Milestones: 1983–1994 (continued)

1991 SYSTEM 7 CHARMS, BEFUDDLES USERS

◆ Apple and IBM sign cooperation agreement, leading to adoption of IBM's PowerPC CPU and joint efforts PowerOpen, Taligent, and Kaleida.



◆ Apple introduces System 7.



◆ Apple ships the StyleWriter.

◆ Quadras and PowerBooks are introduced.

◆ Apple announces QuickTime.

◆ Microsoft Windows 3.1 is released.

1992 YEAR OF THE POWERBOOK

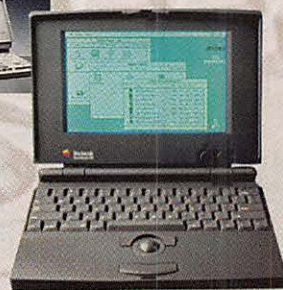
◆ Intel announces PCI bus. Most major vendors, including Apple, commit to supporting it eventually.

◆ Apple introduces Duos and Performas.

◆ Apple ships Apple-Talk Remote Access.



◆ Major push into consumer markets by Apple, Compaq, others.



◆ Three years after Apple's Portable misstep, the PowerBook becomes best-selling notebook. In 1993, IBM's ThinkPad pushes PowerBook to number two.

Art credits (left to right): Rob Dudley, Michael Jay/Apple Computer, Apple Computer, John Greenleugh/Apple Computer, Jonathan Levine, Frank Pryor/Apple Computer, Doonesbury © 1993 G.B. Trudeau/

Adobe to publish the Type 1 font specifications, which resulted in lower prices for Type 1 fonts. And from the what-goes-around-comes-around department, Apple's QuickDraw/GX, due for release in 1994, will provide an open font architecture in which Type 1 PostScript fonts will be treated as equals with TrueType fonts instead of being relegated to the Extensions folder.

Publishing for the masses This progress in output and font technologies was driven largely by the popularity of publishing programs, particularly the first viable one, Aldus PageMaker, released in late 1985.

The premiere edition of Aldus's newsletter, *The Aldus File*, illustrates the state of desktop publishing in early 1986. The fonts are Helvetica and Times: PageMaker 1.0 supported only the 13 fonts built into the original LaserWriter. Character spacing is crude: PageMaker 1.0 lacked the control expected in professional typesetting. The newsletter is only 8 pages long: PageMaker 1.0 was limited to a maximum of 16 pages. And the scanned picture accompanying Aldus president Paul Brainerd's commentary was coarse.

This crudeness also illustrated the state of the Mac's hardware and system software. The 512K Mac couldn't reliably connect to a hard disk, so PageMaker 1.0 was designed to run on a 512K Mac with two floppy drives; the PageMaker manual showed how to configure two floppies to have room to create a publication. No scanners were available that could capture levels of gray. A two-floppy Mac couldn't have stored the images anyway, much less displayed their gray levels on

the screen. The desktop publishing world was in its infancy.

Over the years, PageMaker and its main rival, QuarkXPress, have made straightforward the type of publication design that were nigh impossible with traditional tools: gradient fills, nonrectangular text wrap, and font alteration. Equally significant, desktop publishing and laser printers let people from all walks of life and degrees of talent produce their own publications.

Bringing pictures to the desktop In desktop publishing's early days, photographs were second-class citizens. Early scanners could capture only 16 gray levels. Software vendors had yet to standardize on a file format for scanned images; Aldus and Microsoft didn't develop the TIFF standard until late 1986. So most pioneering publishers who bothered with scanners used them only for creating for-position-only images, which showed a professional printer where to strip in a photographic halftone.

In 1987, the Mac II changed all this. The Mac II made scanners far more viable by making it possible to view gray-scale images without the detail-destroying dithering patterns that monochrome Macs used. The II's ability to accommodate higher-capacity hard drives made it possible to store large image-files, and the II's ability to accept large-screen display boards (thanks to the introduction of NuBus) made it possible to display images without requiring constant scrolling. And the II's speed let the machine manipulate scanned images at a reasonable pace. The Mac had already become a typesetter. Now it was about to become a darkroom.

The first commercial gray-scale image-editing program was Letraset's ImageStudio, which was released in 1987 and developed by Mark Zimmer and Tom Hedges, founders of a small software company now called Fractal Design Corporation. (ImageStudio's capabilities even attracted the attention of the Central Intelligence Agency, which bought many copies.) Around the time of ImageStudio's release, scanners capable of discerning 256 gray levels were becoming common.

Making color computing a reality Although the Mac II supported color, it initially wasn't up to color-image editing. The original Color QuickDraw worked with a maximum of only 8 bits per pixel, allowing 256 colors. That nicely matched the capabilities of the first color-video boards and of early color-paint programs, such as SuperMac's PixelPaint. But 256 colors were too few to render color photographs realistically.

One video hardware developer, RasterOps, worked around this problem by developing video boards that split red, green, and blue pixels across separate image planes, each of which stored 8 bits per pixel. These first 24-bit video boards painted images in three passes, and the mouse pointer flickered distractingly as they did.

The Macintosh platform wasn't up to the demands of photo-realistic color imaging until Apple released 32-bit QuickDraw in early 1989. It made true color viable by treating each pixel as a chunk of 32 bits: 8 each for red, green, and blue, plus 8 for an optional alpha channel, which imaging-software developers could use for special purposes such

1993 NEWTON SHIPS, WHY CAN'T IT READ?

◆ Apple loses its suit against Microsoft and Hewlett-Packard for infringing Mac look and feel. Microsoft previews Windows 4.0's very Mac-like interface.

◆ First portable document software released (Common Ground, Acrobat, Replica).

◆ Apple realigns its products into business, consumer, and education markets.

◆ Apple announces Macintosh Centris, LC III, and AV Macs.

◆ Apple ships first servers; AOCE follows six months later.



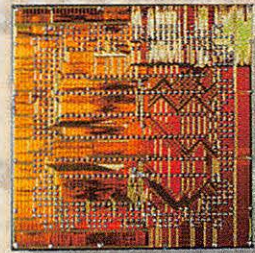
◆ Apple introduces Newton.



◆ First Pentium-based PCs appear.

1994 POWERPC TRANSITION

◆ Microsoft expects to deliver OLE 2.0 document-centric technology in the spring; Apple plans OpenDoc alternative for late 1994.



◆ First PowerPC Macs are introduced.



◆ First 80MHz PowerPC Macs are due by late summer.

◆ First notebook and desktop Macs based on PowerPC 603 CPU should be available by fall.

Universal Press Syndicate, Rob Dudley, Luis Delgado. Background images courtesy of John Greenleigh/Apple Computer (left), and Luis Delgado (right).

as masking. Originally released as an operating system extension (albeit a buggy one), 32-bit QuickDraw is now built into the ROM chips of all color-capable Macs.

The 32-bit QuickDraw made possible an explosion of sophisticated graphics and imaging software, from color image-editing programs such as ColorStudio and Adobe Photoshop to 3-D rendering programs such as Strata's StrataVision 3d and Pixar's Showplace. And as 24-bit video boards became common, true-color scanners appeared that made desktop color scanning a reality.

But as more and more users began working with multimegabyte image files, weaknesses in the Mac's hardware and system software became apparent. One problem was performance: the relatively slow data-transfer rate of a NuBus slot combined with the fact that the Mac's CPU was intimately involved in data transfers to and from video memory caused true-color images to ooze onto the screen. Several video hardware developers addressed this problem with accelerated video boards, whose on-board processors relieved the Mac CPU of much of the grunt work.

Another weakness of the Mac was that printed output often didn't match what the user saw on screen—a problem for a color-imaging platform. Color-matching wrinkles are only now being ironed out, thanks to color-management software such as Apple's ColorSync and Electronics for Imaging's EfiColor, and thanks to calibration hardware such as Kodak's ColorSense.

Today, the combination of a mature

24-bit color technology and quickly maturing color-management systems have made the Mac the premier platform for color imaging.

Handling the Data Explosion

The impact of true-color technology has been felt in the storage industry, too. Besides clamoring for higher-capacity hard drives, color professionals have demanded faster storage systems that improve the performance of disk-intensive imaging programs such as Photoshop.

Apple has been slow in responding to this aspect of Macintosh performance, but progress is being made. The Quadra 900 and 950 have two SCSI buses that can be combined to provide faster performance. The SCSI-2 specification has let vendors offer faster drives in the last few years. And when Apple released the AV Macs last year, it also shipped a long-awaited rewrite of its SCSI Manager, which in version 4.3 now provides better support for the emerging high-speed storage devices designed to take advantage of it.

Once upon a time, a floppy disk was a fairly massive storage medium—368,640 characters!—and with two drives, you could put your PC's operating system and applications on one floppy and your data on another. The Mac offered a little more space—409,600 characters—but that was misleading. Graphical data and applications take more space, plus Macs had only one floppy drive, so the floppy shuffle was born. Developers hand-tweaked code to avoid it, which had the side benefit of making the code run faster and tax the Mac less. But less than a year after the Mac

was released, IBM delivered truly massive storage: the first 1.2MB floppy drive. Apple offered 800K floppy drives only in March 1987, and 1.4MB floppy drives in September 1989—about five years after IBM's first 1.2MB floppy drive.

The Mac was one of the first computers to use the 3½-inch floppy disks encased in a durable shell; most personal computers, including Apple's II series, used the bendable 5¼-inch disks. Its non-standard disk size kept the Mac isolated from other computers—after all, you could get software that let you share disks among Apple II, CP/M, and DOS computers, since they at least used the same floppy media. But today, the 3½-inch disk has finally become the personal computer standard.

But the 3½-inch floppy almost didn't happen: the first Mac prototype that Apple showed *Macworld* in late 1983 used the Lisa's 5¼-inch Twiggy floppies. Ultimately, the 3½-inch disk was adopted because "Twiggy didn't work," says SuperMac's Crow. He recalls the herculean effort to get the 3½-inch drive to work, since it was too late to redesign the Mac ROM's floppy storage expectations of 400K (an amount based on a single-sided Twiggy disk's capabilities). Sony's 3½-inch drives were designed to hold 256K, and Apple engineers eventually had to invent a variable-speed drive to squeeze in the extra data: by reducing its speed, the drive can write more data on the smaller inside tracks. (PC drives are single-speed, so they can't read a 400K or 800K floppy. On both PCs and Macs, the 1.4MB format is single-speed, which allows cross-platform disk exchange.)

The Rest of the World

Connectivity was one of the Mac's strong points from almost the very first model, with the release of AppleTalk in 1985 and the inclusion of LocalTalk ports from the Mac 512K on. It's easy to take LocalTalk for granted, but it introduced concepts that remain advanced today. Perhaps the most notable is that network nodes are dynamically configuring, so you can plug and unplug nodes at will without reconfiguring the network.

With the simplicity of Apple's LocalTalk connectors and Farallon Computing's inexpensive PhoneNet connectors that used standard phone wiring, people began putting together small departmental networks—often no more than combining a LaserWriter with several Macs,

tris and Quadra Macs use A/UX, Apple's version of Unix, since Unix has all the necessary server functions built in. And Apple is porting the Macintosh Operating System to workstations as part of the joint IBM-Apple Unix-based PowerOpen operating system now under development; these workstations will have the horsepower to be business servers in mostly-Macintosh environments.

Apple has also begun adding some server functions (like System 7's file sharing and System 7 Pro's PowerTalk mail handling) to the Mac Op-

dows?" asks Fractal Designs' Zimmer.

The cross-platform trend worries many developers, even those who profit by it. "Apple's role in the marketplace is to do unique things," says Microsoft chairman Bill Gates in a sentiment echoed by most developers. "You can't just

stay on the same old unique thing you did ten years ago," he advises. The Windows trend worries Apple, too, which is why it has a new software division, called AppleSoft, that will develop programs that take advantage of the Mac's unique capabilities,



We had the vision

that you shouldn't have to add to the Mac to make it useful. But the lack of SCSI was simply a mistake.

GEORGE CROW

ORIGINAL MAC DEVELOPER

since the LaserWriter was a very expensive peripheral then, costing more than a Mac. PhoneNet's plug-and-play nature was critical for the corporate Macintosh users of the day, since they often had no formal support from their companies' MIS departments, says Reese Jones, a founder of both Farallon and BMUG.

PhoneNet's invention occurred at a fortuitous time, Jones recalls: the Bell System had just been broken up by a federal judge, and a result of the breakup was to make consumers responsible for the phone wiring in their homes and offices. That meant they could now install a phone-wire-based, networklike PhoneNet. "Before that, PhoneNet would have been illegal," Jones says.

Starting in 1991, Apple pushed to make Ethernet the new Mac network standard by including Ethernet connectors in many Macs, particularly in its then-new Quadra line. Apple's goal was to promote larger Mac networks. But Apple has long wanted to make Macs more than just departmental computers—it wants them to be servers, not just clients. In fact, Apple announced a Macintosh server in 1985, but it never shipped. In 1993, Apple introduced the Workgroup Servers; these modified Cen-

erating System, since small departmental networks based on file sharing still make up the majority of Mac networks today, says Morris Taradasky, vice president of Apple Business Systems.

The Windows Question

It's a rare business-oriented Mac application today that doesn't have a Windows version. The Windows market is twice that of the Mac market and growing faster, so Mac developers see a way to get a piece of a bigger pie. And Windows developers are porting their applications to the Mac for what they hope is an inexpensive way to access a secondary market. The growing availability of cross-platform development tools (even Apple has one) makes this easier than ever.

But the move toward cross-platform software may mean the Mac will lose its uniqueness. Apple has thus resisted porting some of its new technologies (like the much-delayed QuickDraw/GX) to Windows, for a simple reason: "If we port them to Windows, no one will need to buy a Mac," admits one Apple engineer. Yet developers are pressuring Apple to deliver the goods on Windows so they can offer identical cross-platform products. "What good are Apple events or QuickDraw/GX if I can't use them on Win-

such as those introduced in the AV Macs.

But Apple is now also willing to profit from Windows and promote interoperability with it. For example, Apple sells CD-ROM kits for PCs, and a DOS coprocessor board for the Quadra 610, Windows-compatible printers and scanners, and through its Claris subsidiary, database software (and soon drawing software).

Whatever the outcome of the Windows-Mac competition, it's undeniable that the Mac made the graphical approach a reality. With the Mac, "this power was brought to a larger number of people, and thanks to its successor, Windows, to a yet larger set of people," says Joanna Hoffman, a member of the original Mac development team responsible for much of the early marketing.

A Peek Ahead

Technologically, Apple is banking on the fast, cheap PowerPC CPU in the short term to make the Mac at least price-competitive with Windows PCs, if not cheaper and faster (see "PowerPC Preview," this issue).

Over the long term, Apple continues to wrestle with wanting to be a technological innovator—for example, with its plans for AppleSearch data navigation,

The Evolving Mac System

Apple's ambitions have usually been a little bit ahead of the available CPU technology. The original Mac graphical interface was an uncomfortable stretch for the poor old Motorola 68000 processor. When color Macs appeared, sporting the faster 68020, they hit the Adobe Photoshop wall. People could process large color files—but agonizingly slowly. With successive processors, Macs got faster, only to encounter new technologies—such as QuickTime and voice recognition—that again strained processing and data-throughput limits.

That pattern will soon change. RISC (reduced instruction set computer) processors, multiprocessor computing architectures, and data buses now on the drawing board will be fast enough for almost any task Mac people have yet envisioned.

The RISC difference The 68040, first seen in Quadras and now in mainstream machines, represent (along with Intel's Pentium) nearly the final evolutionary stage of the CISC (complex instruction set computer) on a single chip. Because CISC designs have begun to reach a point of diminishing returns, designers



RADIUS'S STEVE HOLMLUND: UNDER OPENDOC, MULTIPROCESSING WILL BEAT ANY SINGLE-PROCESSOR SYSTEM

have turned to RISC chips.

The RISC-based PowerPC 601 chip, the core of PowerPC Macs slated for release this spring, relies on fewer than half as many basic instructions as the 68040 to accomplish the same tasks. A PowerPC 601 Mac running at 80MHz should operate two to four times as fast as a Quadra 800 (see "PowerPC Preview," this issue).

That should take care of routine chores, but what about

image processing and large-scale database work? The first path to boosting power is to squeeze more from a single chip. Motorola's planned PowerPC 620 will have 64-bit-wide registers and data paths (the 601 chips are 32-bit). This will let the 620 handle more instructions simultaneously, which should make it four times as fast as a 601.

But don't expect a 660 chip any time soon. Designers are reaching the limits of how many transistors they can add without causing the CPU to overheat. Meanwhile, the ramp-up costs for each new generation of CPUs are becoming prohibitively costly—another practical limit on single-chip power.

Side by side by side Mac hardware developers therefore see the future of increased power in combining processors. One such approach is to divide a task among two or more chips and run them in parallel. "Image modification and 3-D graphics are natural tasks for dedicated parallel accelerators," says Jay Torberg, vice president of engineering at SuperMac.

But parallel processing software has proved elusive for most business applications. That's where multiprocessing—using a separate CPU chip for each application—comes in. Excel, 4th Dimension, and a fax modem, for example, would each get a 601 CPU and an allocation of main memory. (The AV Macs, which combine 68040 and digital signal processors, use this approach.)

Steve Holmlund, who directs multiprocessing development at Radius, thinks that multiprocessing will work well with forthcoming document architectures that have documents made of parts—for example, text, a graphic, and a chart—and small applications that are content modifiers (see the sidebar "Transforming the Mac Interface"). "If you have dedicated processors and memory driving each part, you will be faster than any single-processor

system," Holmlund says.

Even without document architectures, many Macintosh users keep several applications open at once, making multitasking an obvious pathway to power as system architecture evolves.

Moving data faster But high-speed processing is less significant if data can't move equally quickly to the hard drive or across the network. And the Mac's venerable NuBus input/output standard can't keep up with such data-transmission rates. Thus, Apple has endorsed the faster, cross-platform Peripheral Component Interconnect (PCI) bus (already adopted by IBM, DEC, and Compaq) as the expansion bus on the PowerPC Macs for 1995 and beyond.

But bear in mind that you can't even buy a PCI-based Mac yet. And already PCI can't keep up with high-end data network communications involving 100MB-plus files. For that, we turn to QuickRing, an Apple design implemented by National Semiconductor. Two QuickRing network nodes can transmit and receive at 200MB per second—fast enough to exchange full-screen video or to download 200 records (1MB each) on your company's annual sales in less than 2 seconds. So far 11 companies have announced QuickRing products; the standard should be with us through the year 2000.

All this computing power would seem wasted, though, if it were used only to speed up existing applications. I recently gave a

Newton demonstration for a ten-year-old, who then asked, "When can I have a computer at school with a screen the size of the desktop? I could do all my arithmetic problems and fix my spelling on it, and the teacher could just look at it from her desk screen." A pen-based system of this kind would require astronomical processing power. Now there's an idea that looks more like the future than faster Photoshop masks.—Charles Seiter

Graphical Interfaces Everywhere

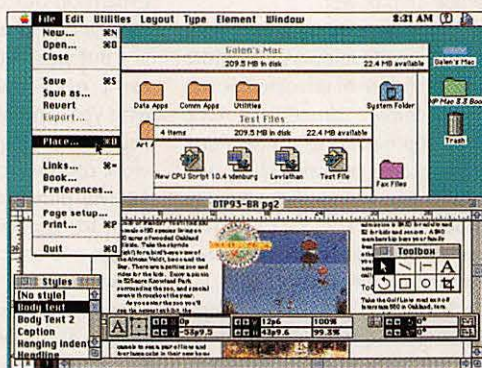
Ten years ago, the Mac stood apart, thanks largely to its graphical interface. Today, it seems that every computer has such an interface, as the accompanying screen images show.

Perhaps the most well known is Microsoft Windows. Over the years, Windows has gotten more Mac-like, although all graphical interfaces share many of the same basic structures. One reason for the similarity is that they are all based on the use of real-world metaphors, so it's not surprising that the

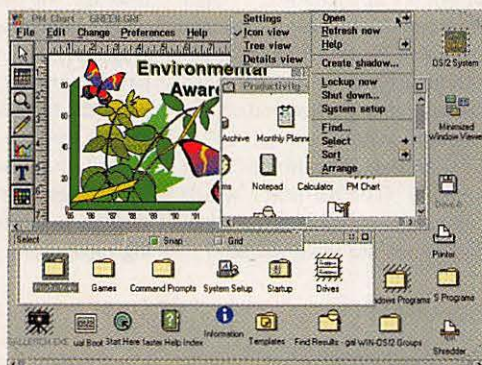
ideas of, say, folders and documents are common. Another reason for the similarity is that most current interfaces, including the Mac's, evolved from the same interface research. Yet another reason is that interface developers follow what works: it's no surprise that, now that Apple has lost the intellectual-property lawsuit over its interface, the forthcoming Windows 4.0 will use a Mac-like folder icon instead of its current group icon.

But having a good graphical interface is only half the battle: "A Mac application by its very nature has more attention paid to its aesthetics. The Mac developer has a head start compared to a Windows developer," says Lee Lorenzen, who worked on an early PC graphical interface called GEM and is now president of Altura Software. This head start helps Mac developers port their programs to Windows.

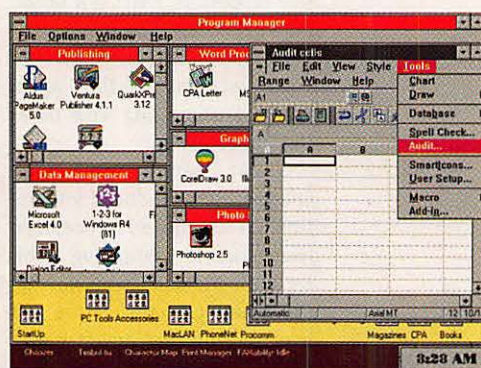
—Galen Gruman



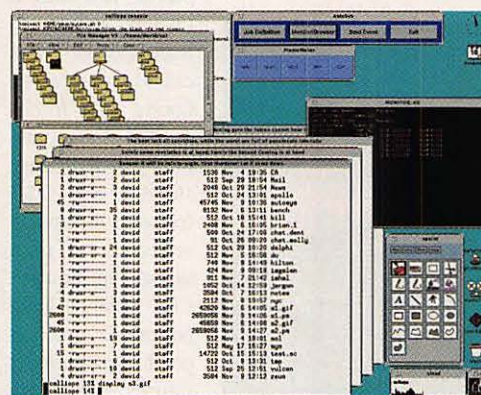
APPLE MACINTOSH SYSTEM 7.1



IBM OS/2 PRESENTATION MANAGER 2.1



MICROSOFT WINDOWS 3.1



SUN MICROSYSTEMS OPENLOOK FOR UNIX

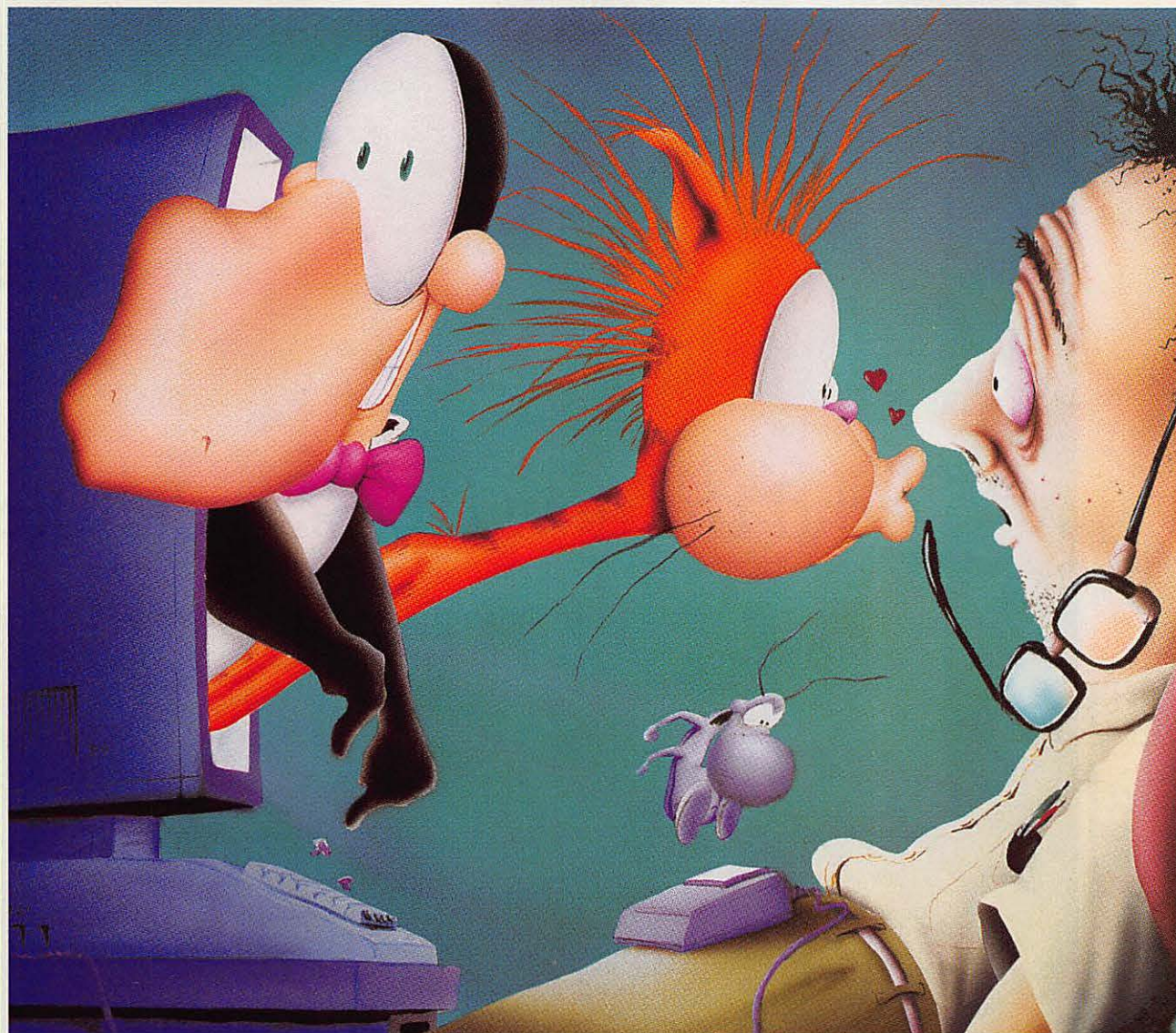
OpenDoc document-oriented tools, PlainTalk speech recognition, and audio/video processing—while also wanting to be accepted by and compatible with the larger business market. Apple's goal seems to be to make the Mac capable of running Windows while also offering the unique features of the Mac Operating System; that way Windows users can buy Apple hardware and discover the

joys of Macintosh software, while Mac owners can stop justifying their choice of computer.

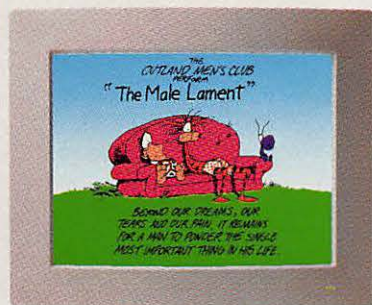
With the Mac, Apple has clearly succeeded in delivering useful innovations, and through what it's given to the computer industry as a whole, it has also succeeded in bringing those innovations to the world at large. The evolution is clearly not over. **m**

GALEN GRUMAN is a *Macworld* senior associate features editor; the first computer he ever worked on was an IBM mainframe. The second was a 64K Apple IIe.

Contributing editor JIM HEID's first computer was a 4K Radio Shack Model I. He began working with the Mac in 1983, several months before its introduction.



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PowerPC Preview

Y

ou probably never thought about having monophonic TV until television stations started broadcasting stereo. And few of us knew our Macs were complex instruction set computers (CISC) until chip manufacturers started making reduced instruction set computer (RISC)

After 10 years of Macs based on the 68000-

processors. In the next few months, Apple plans to trot out the first Macs running on IBM/Motorola PowerPC RISC processors rather than on Motorola 680X0 CISC processors (680X0 is pronounced *68-kay*). The new breed of Macs will look like today's breed even after you start them up, and they will run almost all the software you already have, as is. Moreover, most add-on hardware will work on both 680X0 and PowerPC Macs. To benefit from a PowerPC Mac, you must run new and upgraded software written for it. Then you will feel two to four times the speed of a Quadra 650 running 680X0 versions of the same software. Apple hasn't specified prices and configurations yet but has implied that the first PowerPC Macs will look and cost like today's Quadra 610, 650, and 800 models.

PowerPC performance has arrived in the nick of time for Apple, and not by accident. For some time now, the fastest Macs have run slower and cost more than competing DOS and Windows PCs based on Intel CPUs. Plus, it's clear that the

processor family, prepare yourself for the next generation of Macintosh CPUs

10
Macworld
INTO THE NEXT DECADE



CISC architecture used in Motorola's 680X0 CPUs, and even in Intel's faster 486DX and Pentium CPUs, is reaching its maximum possible performance. "The PowerPC 601 is a great chip now, with lots of headroom, whereas the Intel architecture is starting to max out," says Steve Guttman, senior product marketing manager at Adobe Systems.

Changing CPU architectures is a major effort for any computer maker, since it requires redesigning the operating system to deal with the new CPU. But by making the switch, Apple should ensure that the PowerPC Macs are at least as fast as competing Windows PCs now. And the PowerPC architecture promises to become even faster over the next two years.

Initially, the PowerPC's sole advan-

we spot-checked a cross section of Macintosh software and hardware developers, few of whom reported any compatibility problems with their current products.

Operating system You already know how to use a PowerPC Mac if you are among the 59 percent of Mac users who now use System 7. That same version of system software will control what you see on a PowerPC Mac screen and what you do with the keyboard and mouse. Like other new Macs, the PowerPC Macs will require a specific System Enabler in the System Folder. Apple hasn't

Most of these products fail because they bypass 680X0 Mac programming conventions and either infiltrate the operating system or work directly with the hardware. The PowerPC Macs retain 680X0 conventions but change the hardware and system software behind them, causing incompatibilities among programs that bypass the conventions.

The PowerPC Macs' high level of compatibility is possible even though PowerPC CPUs have a completely different language, or set of instructions, than 680X0 CPUs. An emulator program in



The PowerPC 601

is a great chip now, with lots of headroom, whereas the Intel architecture is starting to max out

STEVE GUTTMAN

SENIOR PRODUCT MARKETING MANAGER, ADOBE SYSTEMS

tage will be speed, but Apple hopes developers will use that extra speed to introduce innovative capabilities that current Macs just can't manage. "The PowerPC may do like PageMaker did: allow a new type of technology," says Brodie Keast, Apple's director of product marketing. He points to telephone, voice mail, teleconferencing, video, and other AV technologies that Apple introduced in 1993 but that, to be commonly used, need more power than the 68040 CPU offers.

Making the Transition

The PowerPC is a new family of CPUs, but the computers that Apple makes with them will still be Macs. For users, the transition will be a lot like changing from a 68000 Mac to a 68030 or 68040 Mac. Most people will upgrade and buy new software to take advantage of the new performance level, and some people will experience problems. But the transition to PowerPC Macs will not be at all like moving to a Windows PC from the Mac—you will not have to relearn the basics.

Furthermore, the transition to a PowerPC Mac should present less compatibility trauma than previous noteworthy transitions, such as to System 7 in 1991 or to the IIcx and 32-bit addressing in 1989. At *Macworld*, we were skeptical until

said whether it will introduce a new version of System 7 with the new machines or continue shipping System 7.1.

Apple ought to bundle optional system extensions such as QuickTime (for motion video), QuickDraw/GX (for drag-and-drop printing to multiple desktop printer icons, portable documents with embedded fonts, dynamic type manipulation, and multilingual text), and PowerTalk (for integrated E-mail and other collaborative services). However, Apple has not yet committed to doing so. Apple says the PlainTalk extension (for speech recognition and text-to-speech conversion) will be available on the PowerPC CPU, but the company hasn't said when that will happen or whether PlainTalk will require an add-on coprocessor.

Software compatibility All types of 680X0 software work fine on PowerPC Macs, according to developers of representative word processor, spreadsheet, page-layout, image-editing, presentation, database, graphics, integrated, macro-utility, E-mail, and disk-driver software.

That doesn't mean everything will be compatible: about 10 percent of applications, extensions, and utilities tested at Apple's PowerPC compatibility lab don't work on PowerPC Macs, say both independent developers and Apple engineers.

the PowerPC Mac's ROM translates 680X0 instructions to PowerPC instructions behind the scenes while the 680X0 software is running (see the sidebar "How Tomorrow's Macs Run Today's Software").

Since the emulator doesn't translate FPU instructions, 680X0 software that requires a floating-point unit won't work on a PowerPC Mac any more than such software works on a Centris 610. Apple has decided not to make the emulator compatible with the 680X0 FPUs because only a few programs require the 680X0 FPU and because Apple expects developers to offer PowerPC versions of these programs soon after the PowerPC Macs are released, says Jim Gable, product manager for PowerPC hardware.

The emulator interprets the instruction set of a 68LC040 (a 68040 without an FPU), so any application compatible with this CPU's instruction set should be compatible with the PowerPC. Thus, all types of software will work with the emulator—applications, desk accessories, control panels, system extensions, fonts, disk drivers, you name it. Even parts of the system software itself use the emulator.

In addition, a version of the Unix operating system known as PowerOpen is now under development. All PowerPC

Macs should be able to use PowerOpen when it becomes available to run both Unix software and Mac software compatible with System 7 (including native PowerPC software and emulated 680X0 software). On such systems, System 7 and all its applications will run inside a PowerOpen window. Other PowerOpen windows can run Unix software concurrently. The PowerOpen Association, of which Apple is a charter member, plans to have the PowerOpen specification finished early in 1994. The association does not develop or market PowerOpen software. Apple, however, plans to have its PowerOpen operating system ready for PowerPC Macs by summer 1994. Apple's effort includes developing an extension to PowerOpen, called Macintosh Application Services (MAS), that enables running System 7 and compatible applications under PowerOpen. Apple will license MAS to other association members, and has already done so to IBM.

PowerPC Macs can also run Windows software with Insignia Solutions' SoftWindows. Using Windows 3.1 software licensed from Microsoft, an early SoftWindows version we saw ran Windows applications on a 66MHz prototype PowerPC Mac at about the speed of a 25MHz 486DX-based PC, a configuration equivalent in performance to a Quadra 610 or Centris 650. Ironically, Windows programs using SoftWindows on the prototype PowerPC Macs ran faster than 680X0 programs did. Insignia's license includes the forthcoming Windows 4.0, and Insignia says it will update SoftWindows with that version after Windows 4.0 is released in late 1994.

Software performance Performance of 680X0 software on PowerPC Macs is a bigger problem than compatibility, because emulation cuts performance sharply. Developers have reported that the early prototype PowerPC Macs ran some 680X0 software at the speed of an LC II (which has a 16MHz 68030 CPU), although they ran most 680X0 programs as fast as a IIcx (which has a 25MHz 030). Apple hopes to boost emulator speed to the level of a IIfx or Quadra 605 before it ships the PowerPC Macs. This would be fast enough for emulated word processing, spreadsheets, black-and-white publishing, and other such applications.

For better performance with PowerPC CPUs, Apple has been rewriting the parts of the system software that require the most computational power, such as QuickDraw, using PowerPC native instructions. These changes affect the feel but not the look of System 7 on PowerPC Macs. They also speed up emulated applications because most of them dele-

gate a great deal of work to the system software—some applications spend up to 90 percent of their time using it.

Not satisfied with emulation performance, many developers are rewriting their applications with PowerPC code. Native PowerPC applications should run between two and four times faster on a PowerPC Mac than native 680X0 applications run on a Quadra, according to Apple and independent developers. Tasks that involve lots of FPU calculations should speed up even more. (Apple did not let Macworld Lab test a prototype PowerPC Mac with prerelease software for this article; however, our informal experience with prototype PowerPC Macs confirmed developers' estimates for both emulated and native performance.) So you may want to wait until your most-used programs are available in PowerPC versions before getting a PowerPC Mac.

ACI US, Aldus Corporation, Aladdin Systems, CE Software, Claris Corporation, Dantz Development Corporation, Deneba Software, Frame Technology, Insignia Solutions, Microsoft Corporation, Specular International, and WordPerfect Corporation all intend to port at least some applications either by the time Apple launches the PowerPC Macs or shortly thereafter. None of these companies has yet decided on upgrade policies.

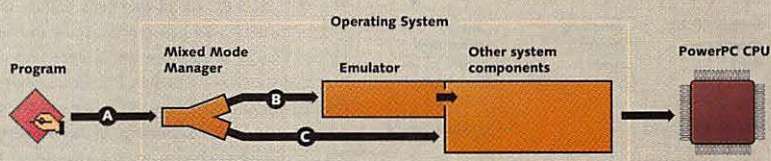
Most developers we spoke with are creating purely native PowerPC applications, but some are creating hybrids that combine emulated and native code, as Apple has done with the system software.

The PowerPC Mac runs native PowerPC software in one mode and emulates 680X0 software in another mode. A new part of the system software, called the Mixed Mode Manager, automatically switches between emulation and native

How Tomorrow's Macs Run Today's Software

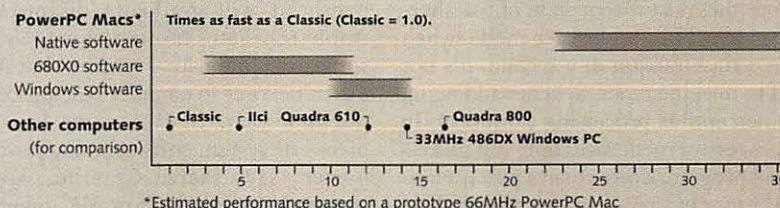
A PowerPC Mac can run software written for a 680X0 (pronounced 68-kay) Mac with the help of an emulator program. The emulator, which is part of the operating system in the PowerPC Mac's ROM, translates 680X0 instructions into equivalent PowerPC instructions. On a PowerPC Mac, System 7 has to decide whether the software it's running—an application, INIT, or System 7 component—is a native program (uses PowerPC code), emulated program (uses 680X0 code), or hybrid program (uses both types of code). Insignia Solutions uses a similar approach to make Windows software run on PowerPC Macs.

To detect what kind of code a program uses, System 7 for PowerPC uses a new component called the Mixed Mode Manager. The manager intercepts every program when launched (A) and decides whether to use the emulator (B) or not (C). For hybrid programs, the Mixed Mode Manager must turn the emulator on and off as the program is running.



Assessing Performance for Different Program Types

Emulation takes time and slows performance, but Apple hopes that the PowerPC CPU's speed will make up for this. Native software does not need the emulator and runs considerably faster. *Macworld* was unable to obtain a prototype system from Apple, but our informal evaluations of early 66MHz versions and reports from developers point to the performance you can expect from different types of software (below) when the first PowerPC Macs are released. Speeds are indicated as ranges because of variance in software and ongoing development of the PowerPC Macs.



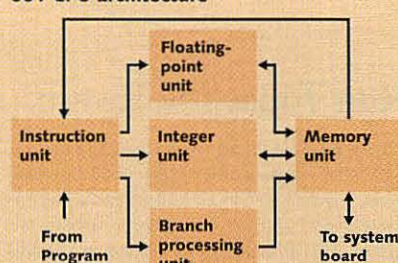
Five Reasons the PowerPC Is a Better CPU

The internal design of the PowerPC 601, a RISC (reduced instruction set computer) CPU, is very different from the Motorola 68040, a CISC (complex instruction set computer) CPU. Apple is banking on the benefits of RISC to make future Macs easily competitive with other PCs in price and performance. In five key areas, the 601 has an edge over the 040.

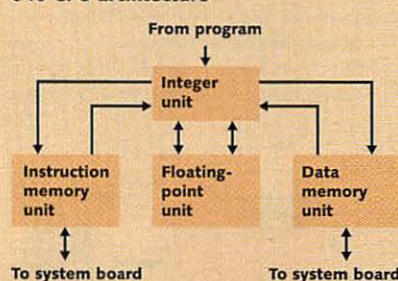
1. More efficient overall design

The PowerPC 601's RISC architecture enables the CPU to process instructions efficiently, by using independent execution units to handle multiple instructions simultaneously. The 68040's CISC architecture usually must shuttle instructions through different units one at a time. The 601 also uses a smaller vocabulary of instructions, while the 040 combines instructions from a large vocabulary into complex instructions that take more processing time. Sometimes it takes several RISC instructions to do the work of a single CISC instruction, but more often than not, the RISC approach is more efficient overall.

601 CPU architecture



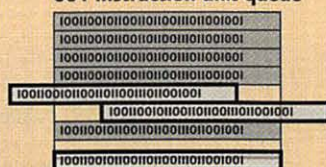
040 CPU architecture



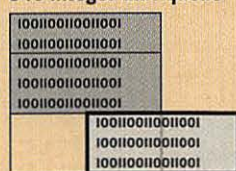
2. More processing per cycle

The 601's instruction unit holds eight instructions and can send up to three per clock cycle to other execution units in the CPU for simultaneous processing. By contrast, the 040's integer unit holds an average of just three instructions and can send only one instruction per clock cycle, in strict first-come-first-served order. The 601 can hold more instructions because its holding slots are longer (32-bit) than the 040's (16-bit). Frequently, only part of an instruction can fit in an 040 slot, so one instruction can take up several slots in the queue.

601 Instruction unit queue



040 integer unit queue

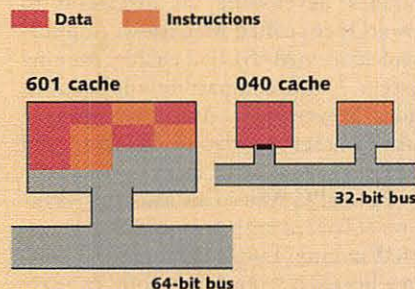


3. Smarter instruction handling

The 601 includes an independent branch processing unit (BPU) that can process some instructions before they're needed by the integer unit. These branch instructions help the CPU decide what set of calculations (a branch) to do based on the CPU's current status. By examining branches early, the BPU can detect when a branch calculation is not needed, thus removing some work from the integer unit. This in turn speeds up overall processing. By contrast, the 040's dependent BPU can only narrow down branch calculation options for the integer unit but not remove unneeded calculations.

4. Better memory handling

The 601 has a large (32K) cache in which to hold frequently used instructions and data, thus minimizing the delays of getting them from system memory. The 601's memory bus handles 64 bits of data at a time—double that of the 040's, so the 601 can transfer more information per clock cycle. The 040 uses two smaller (4K) caches, one each for data and instructions.



5. Faster floating-point processing

The 601's floating-point unit (FPU) is designed to work very fast, so applications that use floating-point math will see great speedup with the PowerPC CPU. (Programs today rely more on integer calculations, which are sped up by a lesser degree on the PowerPC. Apple is thus encouraging developers to use more floating-point calculations.) A major reason for the 601 FPU's high speed is that it works independently of the integer unit, both getting floating-point instructions directly from the instruction unit and processing them while the integer unit is doing other work. By contrast, the 040's FPU must wait for the integer unit to give it floating-point calculations and wait again to pass back the results for further processing by the integer unit.

modes. Each time it switches modes, it pauses normal processing briefly to save the current state of the computer and restore the most recent state of the alternate mode. Thus, while each mode switch takes a tiny fraction of a second, it's not hard to imagine mode switches adding up to a perceptible processing slowdown. In fact, excessive mode switching can make a hybrid program slower than a purely emulated program, requiring careful hybrid design programs to avoid this pitfall.

Even completely native PowerPC

applications incur some mode-switching overhead, because the PowerPC Mac's system software is itself a hybrid. This overhead will gradually disappear as Apple translates more pieces of system software to full native versions, but Apple doesn't expect to complete the process in the first year. In fact, some less-used pieces of system software may never be ported, says Pierre Cesarini, Apple's product manager for PowerPC operating system development. The last pieces to be translated will be the ones that run near-

ly as fast with emulation as without and that switch modes while you are waiting for something else to happen.

Add-on hardware NuBus cards, internal storage devices, external storage, scanners, printers, modems (including ADB modems), graphics tablets, and monitors all should work as well on PowerPC Macs as on current Quadra models. But PDS cards made for 680X0 Macs will not work on PowerPC Macs.

The first PowerPC Macs will use 72-pin SIMMs like nearly all current Macs,

but you will have to install them two at a time. This requirement stems from the fact that PowerPC CPUs access memory 64 bits at a time, whereas the 72-pin SIMMs deliver 32 bits at a time (matching the 32-bit rate of all current Macs). It takes two 32-bit 72-pin SIMMs to make a 64-bit bank of RAM. When 64-bit SIMMs become available, perhaps by 1995, Apple may adopt them and drop the current 32-bit SIMMs.

Apple will stick with NuBus for the first PowerPC Macs but will eventually replace NuBus with a faster expansion bus: Peripheral Component Interconnect (PCI). Intel designed PCI for faster data transfer between expansion cards and the system board, and in theory expansion cards could work in both DOS computers and in Macs. Although PCI has started to appear in DOS and Windows computers, Apple probably won't make Macs with PCI slots until late 1994. You can opt to hold out until then and get a PowerPC Mac, PCI cards, and software upgrades all at once, or you can make the transition in stages. Any NuBus cards you already have should work with the upcoming PowerPC Macs, although some models will accept only 7-inch cards.

Upgrade options The PowerPC's impressive performance potential will be available to anyone in the market for a new computer and to some Mac owners looking for upgrades. Apple intends to offer system-board upgrades for Mac case styles used in the Centris 610 and the Quadra 610; the IIfx, IIfx, Performa 600, Centris 650 and 660AV, and Quadra 650 and 660AV; and the Quadra 800 and 840AV. Apple will also have upgrades for its Workgroup Servers. But Apple usually gives priority to making new Macs, not upgrade boards, so the initial supply of upgrade kits may be short.

It's not clear what a PowerPC upgrade might mean for 660AV and 840AV owners, since the upgrade boards almost certainly will not include a DSP coprocessor. The PowerPC CPU, like a DSP, is fast enough to process audio and video signals as they happen. But doing that work and handling applications will probably slow system performance. In that case, expect to see DSP coprocessor cards offered to make up for the lost performance. Apple has said some PowerPC Macs will support AV technologies, but it hasn't said if any of the first PowerPC Macs and upgrades will have the GeoPort or other audio and video ports.

The upgrade kits are sure to include a system software upgrade that you will have to install on your start-up disk. Expect to be able to use the internal storage devices you already have, but don't

expect to be happy with any old hard drive. You'll need a big, fast drive for this class of computer. To complete the upgrade, you may need faster RAM.

At least one other company will have an upgrade card. DayStar Digital says its PowerPC Accelerator, a PDS card, will be available when Apple ships its first PowerPC Macs. DayStar's accelerator will include a PowerPC CPU and everything else needed to make your Centris or Quadra think it's a PowerPC Mac, says DayStar product manager Ted Cheney. That scheme will include putting the system software in ROM. Eventually, DayStar intends to make versions of this accelerator for other Mac models.

With the DayStar card you won't have to change your system configuration other than updating the system software, says Cheney. This upgrade works with the RAM SIMMs already on your system board; however, the SIMMs can transfer only half as much data at a time as the PowerPC. This slowdown can be reduced by placing high-speed cache memory on the adapter card so that the PowerPC doesn't need to access memory on the system board as often. DayStar hadn't decided at this writing how much cache to include on its PowerPC Accelerator, but it expects the PowerPC Accelerator to be 90 to 95 percent as fast as a replacement PowerPC system board from Apple and to cost less.

When to get a PowerPC What to do until the PowerPC Macs arrive depends on the software you use and the class of desktop system you use or plan to get. The first PowerPC Macs will be midrange to high-end desktop systems, according to Apple, so they affect you only if you're planning to buy a Quadra, an LC 475, or a Performa 475 or 476.

To decide when to buy a PowerPC, ask yourself which applications you could not bear to use at IIfx or LC III speeds, and then wait until all of those are available in native PowerPC versions. But don't hold out for PowerPC native versions of word processor, spreadsheet, single-user database, and other software that performs acceptably at IIfx or LC III speeds, because the 680X0 versions will probably work fine under emulation. If you need a new Mac in the meantime, buy a Quadra 610, 650, 660AV, 800, or 840AV and upgrade to a PowerPC later.

You're not likely to suffer buyer's remorse over the purchase of a PowerBook or an entry-level 680X0 desktop Mac, because those models won't be affected by the PowerPC at least until the third quarter of 1994, when, Motorola and IBM say, a low-power, low-cost PowerPC CPU will become available in large

quantity. And don't hesitate to buy existing software for those models; the software will work at the speed you're used to if you later move it to a PowerPC Mac.

Inside PowerPC

Apple realized more than two years ago that CISC processors such as Motorola's 680X0 family and Intel's 80X86/Pentium family would reach a performance plateau. In 1991, Apple allied itself with IBM and Motorola to create the PowerPC family of RISC processors, whose performance would start near the top of CISC performance and climb through successive generations to a new plateau.

The first of these CPUs, the PowerPC 601, has been shipping in large quantity since September 1993 and will drive the PowerPC Macs and upgrades coming this spring. The 601 is faster than the fastest 68040 and as fast as the Pentium. Future PowerPC generations will be much faster while remaining compatible with programs written for earlier generations, according to Motorola.

Why RISC is faster All PowerPC CPUs achieve their performance by processing instructions faster than CISC CPUs (see the diagram "Five Reasons the PowerPC Is a Better CPU"). The chips adhere to the following design principles of RISC, whose goal is to complete one instruction every CPU clock cycle.

- **Uniform instruction size** expedites the fetching of instructions. RISC processors never have to pause and retrieve additional words to complete a pending instruction, as CISC processors sometimes do.

- **A reduced set of instructions** simplifies instruction processing. RISC chips have little if any of the microcode (microprograms) that tells them how to process complex instructions and sprawls across half of some CISC chips.

- **Simple memory-addressing methods** quickly access main memory on the system board. RISC methods do not include complex calculations and multiple memory references, as the most sophisticated CISC methods do.

- **Limited memory-access instructions** reduce instruction size and simplify instruction processing. RISC instructions that manipulate data never get or put data in memory, but many CISC instructions combine those functions.

- **An abundance of registers** lessens memory accesses. Compared with CISC programs, RISC programs keep more interim results on the chip in registers and fewer off the chip in main memory.

These principles make RISC programs longer and faster than equivalent CISC programs. It may seem that the

shorter CISC programs should be faster, but the microcode required to handle complex instructions slows down the simple instructions that occur most often even in CISC programs, resulting in a net loss of performance.

Performance enhancements Besides adhering to these RISC design principles, PowerPC CPUs also include important performance-enhancing features found in both RISC and CISC processors.

For one, PowerPC CPUs process several instructions concurrently in a multistage pipeline. Each instruction progresses from stage to stage with another instruction in the stage ahead and yet another in the stage behind, like kids crawling together through a culvert one after another. It would take the group longer to get through if each went through alone. The pipeline may stall if the CPU has to wait for instructions coming from (or for data coming from or going to) main memory. CPU designers minimize such stalls by including a cache to store frequently used instructions and data directly on the chip.

The 601 has one 32K cache in which it stores copies of the most recently used memory locations; the cache can contain both instructions and data, as well as locations it guesses may be needed soon. By comparison, 68030s and 68040s have two smaller caches, one for data and one for instructions. The 601's unified cache can't supply instructions and data simultaneously like the 040's dual cache. However, a unified cache is more adaptable to tasks that benefit from unequal amounts of instruction and data, such as applying filters and effects to graphic images.

A different RISC Several aspects of PowerPC design set it apart from other RISC and CISC designs and improve its overall performance.

First, PowerPC CPUs complete several instructions in one clock cycle by simultaneously issuing instructions to multiple execution units within the CPU (called *superscalar instruction dispatch*).

The 601 has three independent, pipelined execution units: a four-stage integer unit, which also handles memory accesses; a five-stage FPU; and a two-stage branch processing unit (BPU). The 601's FPU operates independently of the other units, unlike the FPU built into the 030 and 040 CPUs, which depends on the integer unit to fetch instructions, get data, and store results. The 601's units can complete instructions out of order, but always store results to registers in the correct sequence. Often, a unit that is waiting to store its results can begin processing another instruction.

To keep the integer, floating-point,

and branch processing pipelines busy, a program must have the right mix of instructions. This requirement poses a problem for existing Macintosh programs, many of which have few—if any—floating-point instructions. With the FPU idle, the 601 cannot do better than two instructions per clock cycle. When porting 680X0 programs to the PowerPC, developers must include more floating-point operations so the FPU shares the overall load of running the program.

A second factor that differentiates PowerPC design diminishes a major drawback of RISC processors: they use more instructions to complete a task, thereby increasing program size. PowerPC design includes several compound instructions; that technique helps reduce program size without reverting to full-blown complex instructions. Some compound instructions are particularly useful in 680X0 emulation, including instructions that load or store multiple registers at once, manipulate bits of data or bit ranges, and load or store strings arbitrarily aligned in memory.

PowerPC CPUs also differ from other RISC designs in how they process conditional branch instructions. (*Conditional branches* are like a fork in a path; the CPU bases the decision to continue straight ahead or branch off on certain conditions at the time.) The 601's BPU looks ahead for an upcoming conditional branch instruction and tries to resolve the condition early. If successful resolution does not result in branching off, the program proceeds as if the branch instruction were never there, effectively executing the branch instruction in zero clock cycles. If successfully resolving the condition results in branching off, the BPU requests new instructions along the new instruction path from the CPU's cache.

Other advantages Recent generations of CISC processors—including the 68030, the 68040, and the Pentium—incorporate some RISC features and achieve the basic RISC goal of one instruction per clock cycle. Like the PowerPC, the Pentium has a superscalar RISC core, with an extensive microcode outer layer to support 80X86 CISC instructions. This complexity makes the Pentium more than twice the PowerPC 601's size (292mm² versus 121mm²). Due to its large size, the Pentium uses more power than the 601 (16 watts versus 8.5w at peak use), and the Pentium costs much more (\$898 per CPU versus \$350 for 66MHz versions in large quantities).

The PowerPC Family

The PowerPC 601 is just the first of several PowerPC CPUs now in the pipeline.

The next version, the 603, achieves similar performance with a different internal architecture, says Motorola. The 603 can execute up to three instructions per clock cycle to its five independent execution units: a BPU, an integer unit, an FPU, a load/store unit, and a system-register unit. To keep its pipelines full, the 603 has separate instruction and data caches, each 8K.

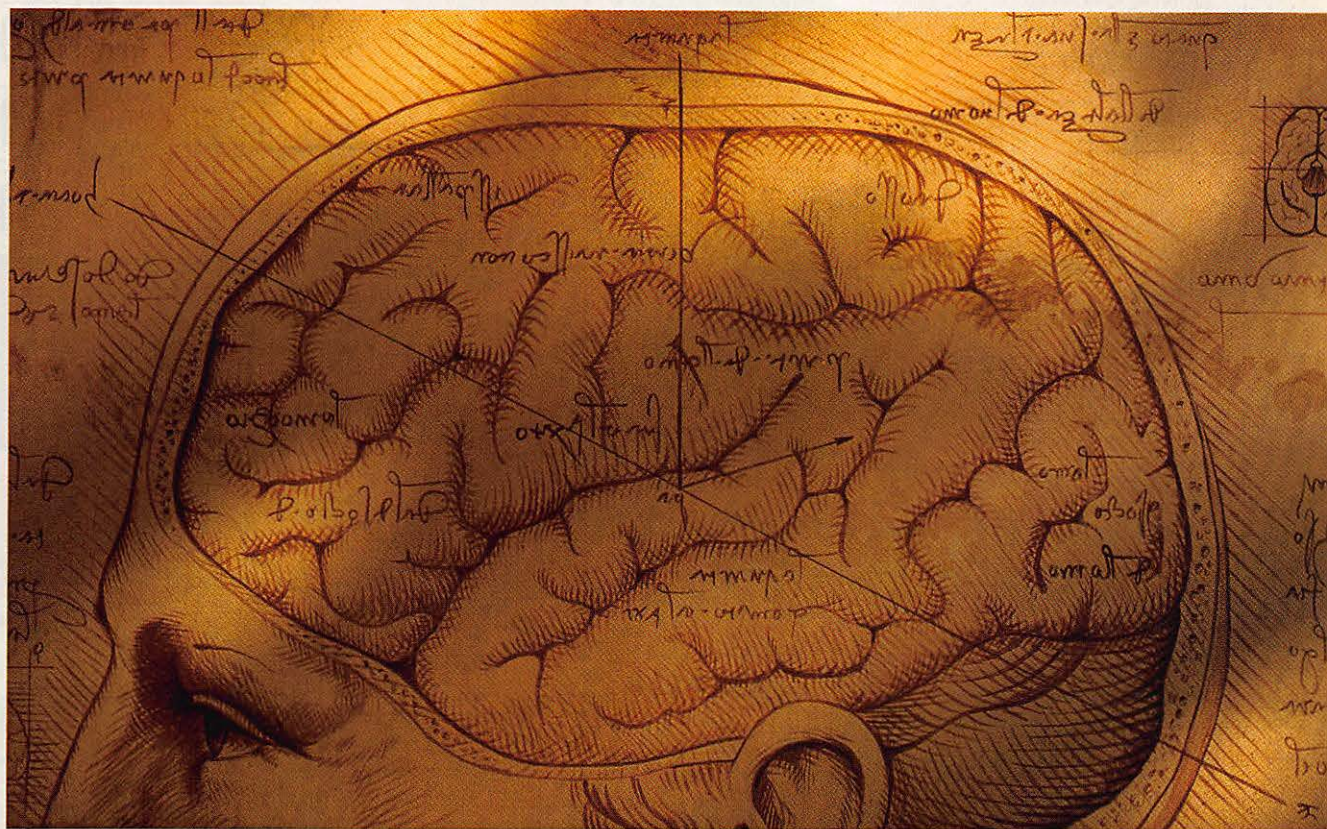
The real advantage of the 603, however, is that it reduces power consumption from its maximum of 3w by shutting down any execution unit not in use and by automatically starting up the unit as needed, all without the software knowing anything has happened. This and other power-management techniques make the 603 well suited to battery-operated computers; Apple plans PowerPC PowerBooks with the 603, perhaps by late 1994. The 603 should also be cheaper than the 601 because it is smaller, so expect to see the 603 used in home and entry-level business Macs. The PowerPC 604, due a year from now, will be considerably faster than the 603; and the 620, due sometime after that, will be considerably faster than the 604, according to Motorola.

Expect the 604 to succeed the 601 in midrange and high-end desktop Macs during 1995. The 603 and the 604 should remain in use for several years. The 620 is being designed for workstations, a faster class of computers than personal computers (including Macs), but a body of compatible software developed for the 603 and 604 together with the PowerOpen operating system would ease Apple's entry into the workstation market. PowerPC software should be compatible with all the PowerPC CPUs despite their very different internal architectures because they share the same instruction set.

PowerPC's Significance

PowerPC CPUs give the Macintosh a future. Apple needs the 601's speed and price to compete with Windows computers based on Intel's 80486DX2 and Pentium CPUs. Already, Windows PCs outnumber Macs more than two to one, and companies that once developed exclusively for the Mac now develop first for Windows. The PowerPC Macs mean you will no longer have to buy Windows to get the best raw performance and price. And the PowerPC CPU gives Apple the core that should assure future Macs will remain competitive with future PCs in terms of both performance and price and that they'll continue to be innovative. **m**

Contributing editor LON POOLE has been reveling in and writing about new Macintosh technology since 1983.



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Figure 1:

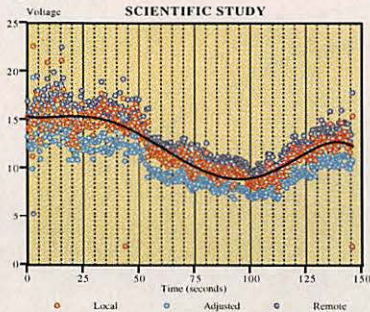


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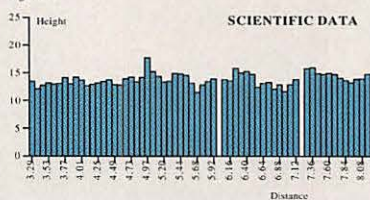
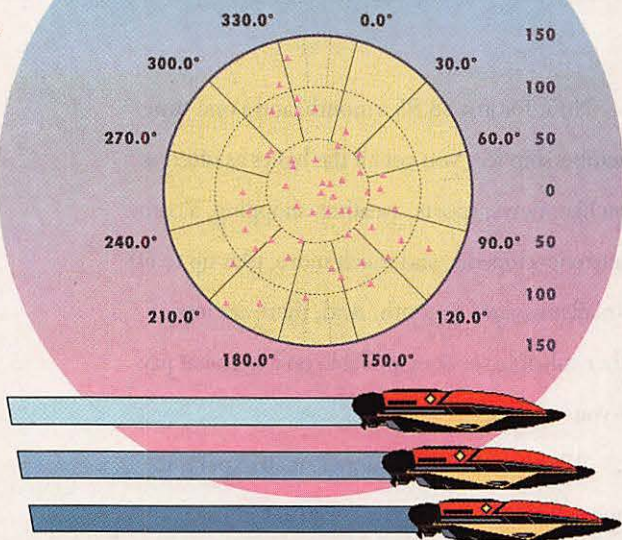


Figure 1: You need nested hierarchies, but the real miracle of microelectronics is that these extraordinarily complex hierarchies can be incorporated into individual silicon chips, with virtual supercomputer capabilities. This fabulous supercomputer power can be ubiquitously distributed in the fiberoptic. No hierarchies do indeed exist, but they are ubiquitously distributed, which renders them an egalitarian force. When everybody commands a supercomputer, you give the average owner of a workstation the power that an industrial tycoon commanded in the industrial era, or that a TV station owner commands in the age of broadcasting. In other words, the hierarchy is in the silicon rather than in the human organization.

Figure 2: When you ride a train you go to the railway station at a scheduled time, you travel with the people who happen to be on the train and you go to preset destinations. This is what the current television world is like. You tune into the stations that have been prescribed through some collaboration between advertisers and TV executives in New York and Hollywood. Moving from broadcast model to the teleputer is like moving from a railroad model to automobiles.

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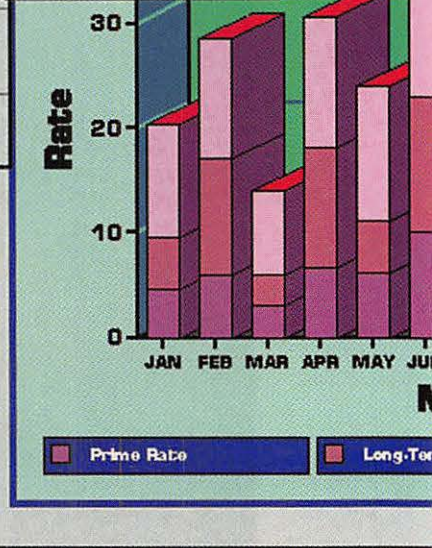
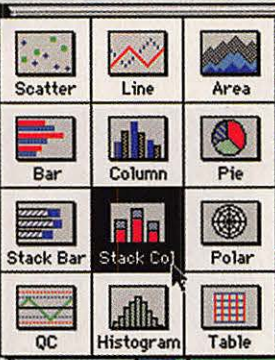
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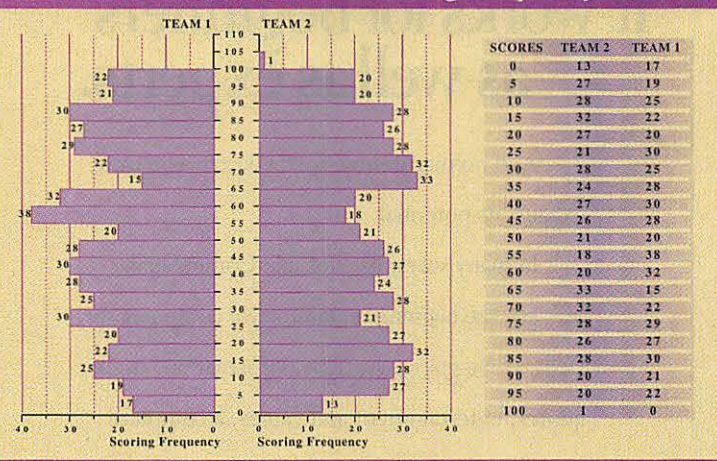
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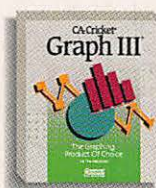


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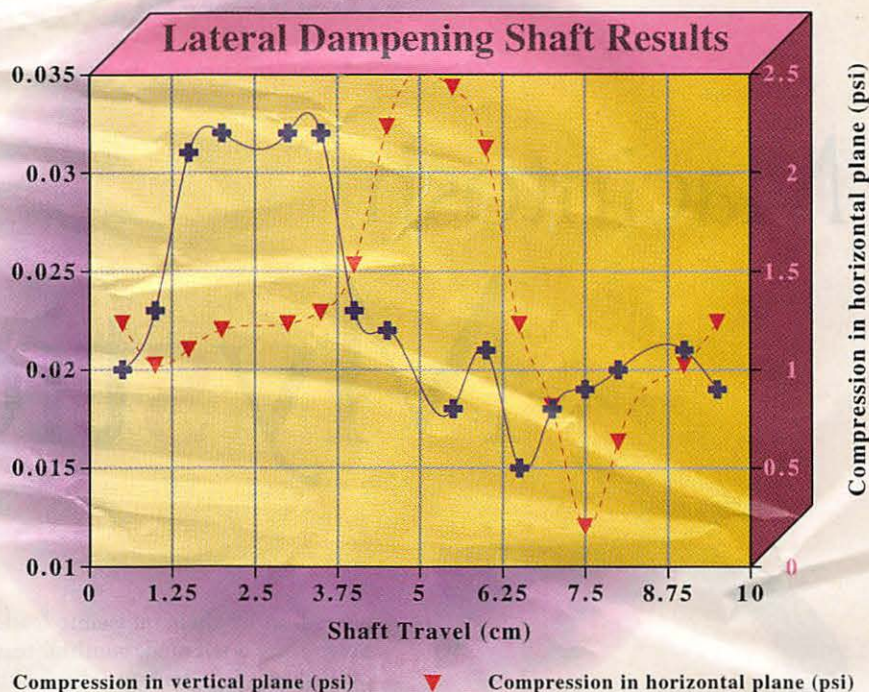
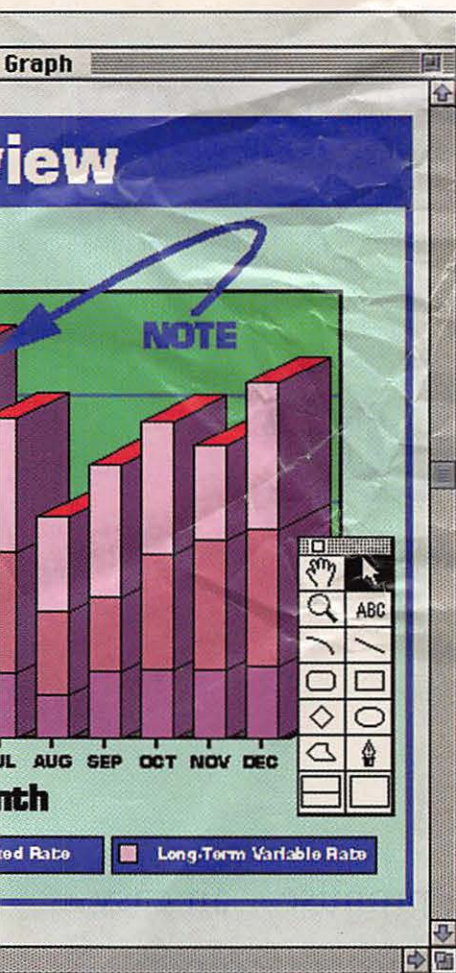
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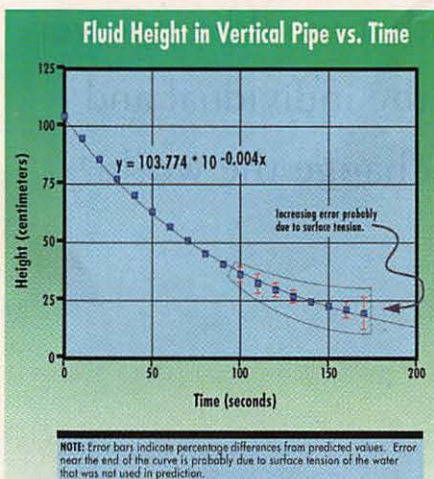


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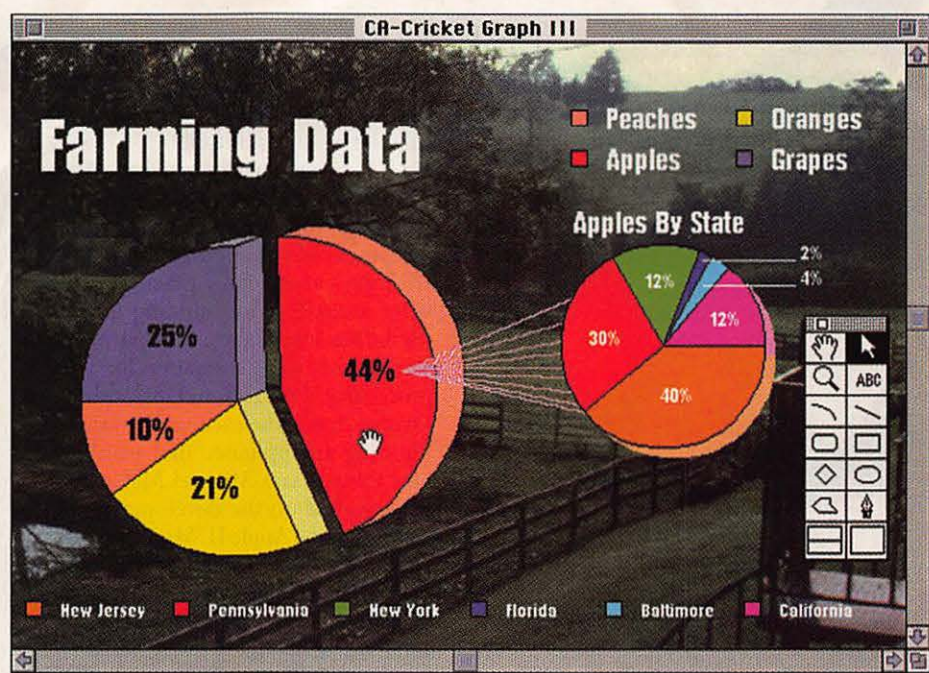
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Circle 10 on reader service card

BY CHARLES PILLER

Photograph by Hans Neleman

Macintosh Mystique

S purred on by their messianic leader Steve Jobs, a talented, youthful team of T-shirt-clad "techno-flower children," as their adman called them, was on a crusade. Working absurd hours and thriving on punishing deadlines,

Did the Mac deliver on its big promise—an easy-

they adopted a cultish dedication to a singular goal: Macintosh.

The people who created the Macintosh viewed themselves as saving humanity from the mediocrity and colorlessness of other computers. "The IBM guys were totally practical. They were excited about building a really useful machine for things that people were already using computers for: word processing, databases, and spreadsheets. Over at Apple, the excitement was over building an appliance that would do new things," says Michael McConnell, who worked on the development and rollouts of the Apple II, Macintosh, and IBM PC, and is now president of SuperMac Technology.

The Mac developers also wanted to save Apple itself from the Apple II and Lisa computers, which they considered dead ends. Jobs's rallying cry for the Mac team was "It's better to be a pirate than to join the navy"—the navy being the rest of Apple. The Mac team wanted a machine for free-thinking, discriminating nonconformists and rebels like themselves. Their spirit inspired the famous "1984" television spot—an outrageous depiction of the IBM PC/Microsoft DOS computer standard as Big Brother—that launched the Mac (see the sidebar "Why the Mac Hasn't Won Over the Masses"). Their vision was the dominant influence on

to-use machine
that would empower
the individual and
change the world?

10
Macworld
INTO THE NEXT DECADE



the Mac and how it developed.

What exactly was that vision? The Mac team wanted to bring computing to people who had neither the patience nor the interest in learning the then-dominant command-line approach. The team was determined to create a machine that was easy and fun as well as functional—a machine that would augment people's creative imaginations. In doing so, the Mac team fully expected to change the nature of computing forever. More than that, the Mac was their act of political rebellion—a weapon to smash the debilitating drudgery of computing's status quo, and by extension, to create a better world.

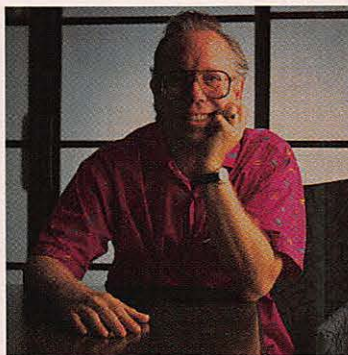
At a glance, the Mac seems to justify such grand ambitions. It stimulates fierce loyalty and sometimes sparks a childlike

human needs and ways of perceiving. From the days of IBM punch cards through the command-line approach, the human interface was treated as an appendage added after most basic hardware and software features were frozen.

Starting from human needs "What was unique about the Macintosh was that it started with the idea of the user interface," says Jef Raskin, original team leader for the Mac. "Then hardware and software were designed to support the human being." The breakthroughs of the Mac interface—graphical icons, screen win-

message has been uncritically adopted by both Mac fans and much of the general public, but the reality is different: *Many people don't get it.* Are they technophobes, or is the Mac interface simply not as easy as the hype suggests?

"My true test here is my mother. I bought her a Mac about four or five years ago, and it was confounding to her," says Paul Brainerd, founder of Aldus and the father of desktop publishing. "Even to this day, when I go home at Christmas, my sister and I always end up having to go through the file folders and fig-



I'm still convinced that the Macintosh empowered more people to write their senators than it empowered to make bombs

BILL ATKINSON

A PRIMARY DESIGNER OF QUICKDRAW AND MACPAINT

curiosity that pushes people to new realms of artistic or musical expression. Others consider the Mac a personal landmark. "It has stimulated my mind more than anything else I've come across in life," notes Peter Smith, an officer of the Boston Computer Society's Mac Group. "There's something close to ecstasy in using the Mac," adds David Drucker, the group's executive director.

But for a moment, step aside from the Mac's emotional pull—a force reminiscent of the American love affair with the automobile—and consider the case for the Mac's four great promises.

- Has the Mac made good on Apple's claims of "radical ease of use"?
- Has it made users more productive, more efficient, and better at their jobs?
- Has it enhanced the power of average citizens in relation to governmental or business institutions?
- Has the Mac changed how society functions? Has it pushed the world toward more humane values, as its makers intended and still suggest? Has the Mac changed the world?

Here's a look at the evidence.

Is "Easy" Easy Enough?

The greatest Macintosh idea was that computers should be designed to fit

dows, pull-down menus, and the mouse pointing device—all were developed in other places. "But the Mac was the first widely available commercial product that was designed by someone who was interested in what a human being needs and wants," Raskin adds. The Mac team had seized on something fundamentally human—that computers wouldn't truly be personal until you could communicate with them using everyday metaphors. This had the effect of making the Macintosh the most approachable computer.

The Mac's approachability definitively shifted computer design toward human factors. The graphical user interface (GUI), popularized by the Mac, opened computing to people unwilling to expend the time and energy to get up to speed on DOS machines. And although Macs are only about 10 percent of all personal computers now in use, the Mac approach has defined all other GUIs, especially Windows, which has an installed base more than double that of Macintosh. "It set a standard that forced companies like Microsoft to respond," says Gordon Eubanks, CEO of Symantec, a leading developer of cross-platform technologies.

How easy is easy? In the words of one Apple ad, "If you know how to point, you already know how to use it." That

ure out how [she] managed to get the machine in such a mess. . . . The Mac is still not that easy. It's not transparent."

Research studies on computer interfaces published in peer-reviewed journals of the two major computer societies (the Institute of Electrical and Electronics Engineers, and the Association for Computing Machinery) suggest that a graphical approach is not inherently easier to learn or use than a command-line interface. The key factor is the quality of the particular interface. If this seems implausible, ask some experienced Macintosh users if they have abandoned icons in favor of text labels, or if they rely on keyboard shortcuts to avoid the mouse. Have a hard time remembering DOS commands? Consider that Microsoft Word's basic "ribbons"—not counting pull-down menus, options, and the ruler—use 59 separate icons to represent standard tools.

"A large percentage of people don't get it," acknowledges Steve Costa, executive director of BMUG. "They don't get the icons, they don't get the mouse. I talk to them on the phone every day. The Mac is not an easy computer, it's just the *easiest* computer."

Still, that's a worthy accomplishment, and Apple's customers know it. A *Macworld* survey conducted for this article

indicates that 88 percent of Macintosh users see their machine as easier to use than other PCs. Only 47 percent of DOS or Windows users see their machine as the easiest. This appreciation helps explain the significantly higher operating-system brand loyalty among people who use Macs. Only 13 percent of our sample Macintosh users said they would be just as happy using another machine, compared with 53 percent and 54 percent of DOS and Windows users, respectively (see the chart, "Mac, DOS, and Windows Users: Three Peas in a Pod?").

Does Approachable Mean Helpful?

Apple, unlike its competitors, has always tried to appeal to people who loathed other computers' design flaws, which caused unnecessary work or needless complexity. Apple posed the Mac as the solution. The Mac's friendly approachability and other ease-of-use aspects do encourage people to take advantage of their computers.

But in some cases easy tools can actually impede solutions to some of the very productivity problems the Mac was supposed to do away with. The Mac's desktop metaphor, for example, was designed to give users a familiar environment. But for everyday, repetitive tasks it sometimes introduces its own brand of complications. Consider how the lack of a Rename command forces users to individually highlight every file that needs to be renamed, rather than issue a command to rename several at once (as you would do if you were telling a person to do the task).

To copy between folders, you must remember a keyboard-mouse combination (option-drag) that rivals any DOS keyboard-only approach for obscurity. Have you ever used the Find command to locate one file among many with similar names? (For example, you may code all your budget files with the prefix "1994 budget.") Unless you know the precise name of the file, looking through a labyrinth of folders usually works faster—the Find command is intuitive and easy, but it's hardly efficient.

Think about the time you've spent clicking on OK in annoying dialog boxes, such as those in communications programs that interrupt your work to ensure the message was received. ("Time for your meeting. Click 'OK' to continue.")

Useless innovation Tools that impose inefficient approaches or make incorrect assumptions are not the only problem. While the Mac GUI makes many applications more concrete and vivid, those applications often duplicate the mistakes of earlier platforms by actu-

ally requiring more effort than the traditional methods they replace. For example, can you key in and print out a check from a personal-finance software program faster than you can write the check by hand? Is it worth keying in scores of addresses and phone numbers from a Rolodex into a software program? Since the dawn of personal computers, they have been marketed as perfect recipe cat-

alogs, something that a \$3 cardholder accomplishes more efficiently.

And Macintosh users, like their counterparts on other systems—spend countless hours learning the latest, supposedly vital features in frequent software upgrades, or just getting used to the quirks of a new interface—slowing down their real work in the process.

The Mac was conceived and promot-

MACWORLD POLL

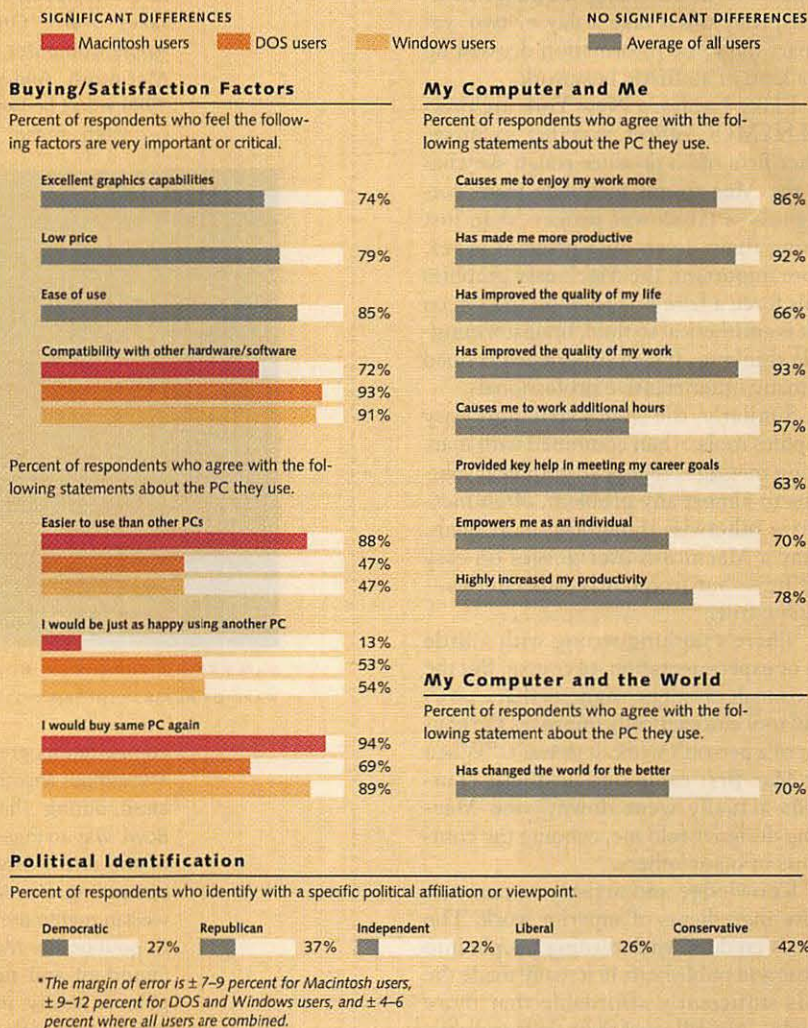
Mac, DOS, and Windows Users: Three Peas in a Pod?

How different are Mac, DOS, and Windows users in their perceptions of computers and computing? To answer that question, *Macworld* conducted a survey of 200 Macintosh, 100 DOS, and 100 Windows users randomly drawn from the subscribers of *Macworld* and *PC World* magazines.

Apple advertising has often posed the Macintosh user as a free-thinking nonconformist. And conventional wisdom suggests that the Macintosh is the machine of choice for people who value strong graphics tools and ease of use. But our survey sug-

gests that the three groups of users are pretty much alike in what they consider important in a computer and in what they see as the influence of their computer operating system on their lives and on the world as a whole.

The only striking differences came in ease of use and customer loyalty, where Macintosh users clearly feel they have the superior brand. Where differences between Mac, DOS, and Windows users were not statistically significant, we have averaged the responses.*



ed as an antidote to other computers' cumbersome qualities, but it only went halfway. The Mac made computing friendlier, and while it's no worse than other computers, the Mac is often no better either when it comes to inefficient or impractical features.

The dark side of graphics The Mac's justifiably famous facility for graphics has also been a mixed blessing. To its credit, the Mac has redefined what is aesthetically acceptable in a multitude of ways. Business charts, graphs, and presentations, for example, are vastly more clear, colorful, and engaging than ever before.

That's why it's particularly frustrating that Mac product advertising and popular wisdom so effectively equate computer-generated graphics with higher productivity and superior quality—a piece of misinformation that frequently spoils the Mac's graphical contributions. While business documents are often prettier these days, prettiness can be distracting and out of context in a memo or report. Simple, practical, in-house company newsletters once took an hour or two to prepare. With the change in design standards, they often take a day or two, yet impart the same information dressed up by a kind of aesthetic busywork.

Pinky Caples, a New York architect and NYMUG officer, says that architects in her firm often produce rough sketches on the Mac to get feedback from colleagues—a far slower process than just jotting them down on a piece of paper. More important, the Mac's easy graphics tools force a false precision on the screen that is antithetical to fluid, brainstorming-style thinking. It's an experience echoed by many other creative professionals.

Similarly, the Mac's strikingly easy graphics tools, when combined with marketing messages that pose graphical solutions to almost any problem, often mesmerize otherwise thoughtful individuals. Many a Macintosh user gorges on easy and fun—but frequently superfluous—graphic frills.

There's nothing wrong with a little fun or experimentation, of course. But the Macintosh mystique suggests that a powerful tool automatically improves the content of a person's work. It doesn't. "When the Mac first came out, aesthetic standards actually went down," one Mac-using designer told me, echoing the comments of many others.

Knowledge and artistry remain the active ingredients of superior work. The Mac is credited with turning people into artists and publishers; it actually made the tools sufficiently affordable that more people—regardless of their skills and abilities—could opt into certain creative

Why the Mac Hasn't Won

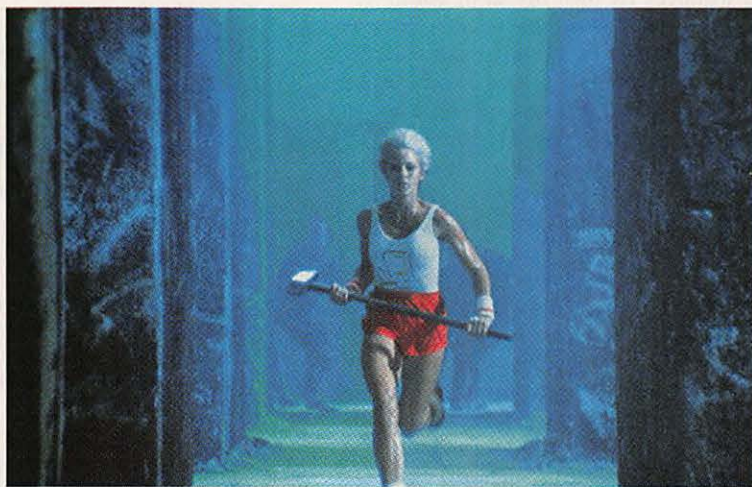
My friends, each of you is a single cell in the great body of the State," proclaimed a giant head projected on a screen facing a mass of drones resembling concentration-camp inmates. "Let each and every cell rejoice! For today we celebrate the glorious anniversary of the Information Purification Directive. We have created, for the first time in all history, a garden of pure ideology . . . We are one people. With one will. One resolve. One cause."

The totalitarian diatribe is shattered by a vibrant, athletic woman who hurls a sledgehammer at the monstrous face. The screen explodes, and the narrator takes over: "On January 24, Apple Computer will announce Macintosh. And you'll see why 1984 won't be like 1984."

With these words, Apple

By making the purchase of a Mac tantamount to an act of sedition, "1984" launched what became an abiding myth of the Mac. Reinforced by Apple, adopted by the Mac's most zealous fans, and abetted by the staid, conservative image of IBM, that myth established the Mac as a machine, as its famous slogan suggested, for "the rest of us"—creative free thinkers, nonconformists, rebels, and agents of change. "Changing the world one mind at a time," another Apple slogan read. "It was about time a capitalist started a revolution," noted another, showing a Mac as a bookend to the works of Marx, Engels, Mao, and Lenin.

The early LaserWriter ads continued the theme with the slogan, "All great revolutions have been started by a single piece of paper," and showed a laser-printed business chart beside the Declaration of Independence and the Emancipation Proclamation.



HAMMERING THE POINT HOME THE MAC INTRODUCTION AD POSED A WOMAN WARRIOR AGAINST THE IBM/DOS COMPUTING STANDARD'S FORCES OF DARKNESS.

committed its greatest blunder. The famous Mac introduction ad, aired during the 1984 Super Bowl, was an ingenious spectacle of the IBM PC/Microsoft DOS computing standard as an Orwellian nightmare. It was meant to position the Mac as the most important and successful computer in history. Instead, it hampered Apple's efforts to turn back the tidal wave of IBM-style PCs.

Radical ease of use The campaign to sell the Mac was never one-sided. Ease of use has been a mantra over the decade of the product's life, although initially it took a backseat to the provocative renegade theme. The issue was value: you can get more out of a computer that is uniquely easy—even fun—to use. It was a direct call to the masses who were frustrated by DOS and

Over the Masses

CP/M or put off by their arcane commands. This was actually meant to be the more important thrust of Apple's two-pronged marketing attack. But the attack failed because it was inherently contradictory. Ease of use—the Mac's strongest mass-appeal argument—was hard to exploit if the target population was a free-thinking renegade elite. (Part of the problem was that when the Mac was introduced only a handful of programs worked on it. Easy to use *what?*)

The contradictions became obvious in 1985, when Apple rolled out the Macintosh Office campaign with an ad called "Lemmings." Blindfolded business executives in blue suits calmly walked off a cliff while whistling a dirgelike rendition of "Hi-ho, hi-ho, it's off to work we go." Unfortunately, the Macintosh Office was little more than a concept. Without products, the Lemmings argument was not just offensive, it was ludicrous.

The rarefied few Apple figured that people "who have a lot to offer but are not technosavvy" represented its core market, according to original Mac marketer Joanna Hoffman's inclusive definition of "the rest of us." Instead, the Mac initially attracted affluent computer enthusiasts who wanted something new and exciting. "We ran out of such people in February 1985," one year after the Mac shipped, says Chris Espinosa, a member of the original Mac development and marketing teams.

More important, Mac buyers were not buying for medium-to-large companies. The Mac never became the dominant force in the personal computer market, in large part because "the rest of us" turned out to be a lot fewer people than Apple envisioned.

Before long, the idea that the Mac was a machine for the rarefied few gained widespread acceptance. Gordon Eubanks, CEO of Symantec and a pioneer on both the Mac and DOS platforms, puts it this way: "Would you rather be the pen that Hem-



OVER THE EDGE THE 1985 "LEMMINGS" AD DIDN'T SELL MANY PRODUCTS, BUT IT CEMENTED THE MAC'S REBELLIOUS IMAGE.

ingway and his friends used in Paris, or the pen that every businessman used?" Apple failed to recognize that businesspeople tend to be more pragmatic than Hemingway was. "Steve Jobs, in particular, thumbed his nose at corporate America, and Apple paid the price," Eubanks adds.

Hoffman wistfully reflects on why the Mac was never embraced by more than about 10 percent of the buying public: "We wanted [the Mac] to be challenging. We wanted it to be exciting. We wanted it to be thrilling! And that meant going after an audience that wasn't a conformist audience. . . . The problem is that the vast majority of the universe are conformists."

Not everyone saw this problem only in hindsight. Selling the Mac as "the computer for the rest of us" was a mistake from the start, says Bill Gates, chairman of Microsoft. "We were always encouraging Apple to tell [the public] that it's for all of us."

A new approach In 1986, Apple seemed to abandon the renegade theme, in favor of going after Gates's "all of us." "The power to be your best" became the dominant line. Apple's new ads emphasized individuality in the time-honored marketing sense—push every consumer to think that buying a mass-produced product makes a personal statement. The recent "What's on your PowerBook?" campaign, for example, featured

colorful personalities showing off everything from novels to recipes to business documents. It also added a strong element of yuppie practicality.

But Apple marketers could never quite wean themselves from the idea that buying the Mac makes a political statement. In 1990, Apple compared the rollout of new Mac models to the fall of the Berlin Wall. The Apple catalog still runs a regular section on "people who changed the world." Apple recently retread "1984" and aired it in Russia, where the old regime ostensibly replaced IBM as the nemesis.

The Mac has fared well in the home and education markets. But in part due to Apple's mixed advertising messages, the Mac



WELL-WORN THEME APPLE IS REPLACING REBELLION WITH THE IDEA THAT YOUR CHOICE OF COMPUTER MAKES A PERSONAL STATEMENT.

simply hasn't yet become a major competitor of the DOS/Windows standard in American business.

fields they previously viewed as inaccessible. (These graphical foibles are equally characteristic of Windows. But Windows is essentially a Mac clone. For better and for worse, graphically oriented computing is the Mac's doing.)

Choosing the right tools When people choose an incorrect tool, it's not the fault of the tool. People are drawn to use the Mac ineffectively or inappropriately because they've come to believe the ads and enthusiasts who insist that it's easier. The Mac is not easier in all cases, but the marketing campaign that produced such claims as "if you know how to point, you already know how to use it" has overpowered that reality. For all its advantages, the Mac is still a complex tool that takes effort and insight to master.

Did the Mac Empower the Individual?

Easy access to good tools often means people will do things—say, look up some information on an online service or build a simple database—that they would otherwise never have attempted. This everyday empowerment can be vitally important to letting people do better work or explore new ideas.

But the Mac went beyond this sort of empowerment, which other computers also provide (although usually with harder-to-use tools). The Mac partially fulfilled its third great promise—personal empowerment—with desktop publishing (DTP). Not only did DTP help people who rely on visual presentation in their work become more effective, it also opened countless creative outlets to teachers, students, nonprofit organizations, and anyone else who could pull together a few thousand dollars. "It's busted wide open industries that historically have been controlled by a small number of gatekeepers," says Howard Reingold, editor of *Whole Earth Review*.

Reingold is right in this respect: DTP has allowed millions of people to communicate in ways that had been practically impossible for most of them. Typesetting and publication-design services were far too expensive for most individuals and small organizations. But for a comparatively modest investment of time and money, the Mac—with Aldus PageMaker, Adobe's PostScript page-description language, and an Apple LaserWriter—offered the means to create publications of all kinds more quickly and easily than even design professionals could do on systems that cost ten times as much.

More important, DTP, as the most influential exponent of graphical computing, changed the computing paradigm. Just as the pioneering spreadsheet Visi-

Calc made the personal computer a legitimate calculation device, DTP based on Mac technology made the personal computer a legitimate communications device. "It marked a turning point in the history of computers," according to Paul Brainerd. "The computer came to be viewed as a tool for creative expression."

Power of the press? But does individual, commercial, and creative empowerment imply economic and political empowerment? Many Mac aficionados argue that it does. For example, Brainerd offers the case of Art Agnos, former mayor of San Francisco, as proof of how desktop publishing is fundamentally altering our political process. Agnos was running behind in the polls and was short on cash when he used the Mac and PageMaker to self-publish an instant political biography that he then distributed to every registered voter in the city.

Agnos won. But what really won it for him? He had the money and personnel to print and distribute the book. Such resources—not a Mac and a laser printer—are the real power of the press. And these resources are becoming more centrally controlled in large corporations and the major media than ever before. The idea of a Mac-wielding David overpowering the corporate communications Goliath is, for the most part, just a myth.

Yes, people have been able to use the Mac to gain an advantage over bigger competitors who rely on traditional methods. But such opportunities typically open up for early adopters in times of any technological transition—only to close rapidly as the technology is more widely adopted. "The Macintosh enabled my three-person [architecture] office to compete at the same quality level as the world-class design houses," says NYMUG's Caples. But the world-class design houses soon discovered Macs themselves, she adds, and her firm was back where it started—unable to compete effectively against large competitors.

Empowering students? The Macintosh has also been credited with playing a major role in empowering people with special needs. For example, Macs have been used to improve the lives of the disabled. But this contribution is hard to distinguish from the role played by computer technology as a whole. The same is true in education. The Apple II, in its obsolescent glory, still enjoys a whopping 49 percent market share in the public schools (the Mac holds about a 12 percent share), and certainly deserves the most credit for introducing students to the possibilities of computing. (That is, excluding Nintendo, present in some 34 million U.S. homes, which has arguably exerted more influ-

ence on children's expectations of computing than Apple and IBM combined.)

No knowledgeable person would suggest that the Apple II is a better education machine than the Mac. And there certainly are many examples of Macs being used creatively and well in the schools. But many Apple II's and IBM PCs are used creatively and well—and, unfortunately, a multitude of computers of all kinds are used so ineptly as to become deterrents to effective learning (see "Separate Realities," *Macworld*, September 1992). Yet through its ads, PR, and education-research pilot programs, Apple has persuaded many that the Mac has made an educational contribution of mythic proportions—a belief that is simply untrue.

Working too hard Before the Mac, many computer users felt that their machines were controlling them by forcing them to adhere to a rigid, arcane command structure. The Mac was developed and sold on the observation that users yearned to break free—that they wanted to become masters of their computers, and by extension, masters of their lives. Did the Mac succeed in empowering users in this way?

On some of the most critical issues, the Mac falls into the same traps as all personal computers (and for that matter, some other standard office machines)—traps that reduce people's power to control their work and manage their time even as they seem to enjoy increased topical range and greater efficiency.

"In the workplace, the computer is not necessarily giving people more control," says Juliet Schor, an economics professor at Harvard University and author of *The Overworked American* (Basic Books, 1991). "Like the telephone, fax, and pager, the computer allows people to get a certain kind of access to you. Every time you turn the computer on, your mailbox is filled up and you've got to go through a lot of mail that you're not interested in. Computing has stupendously reduced the cost of information," Schor says. "Especially people in managerial and professional jobs are finding that part of their job overload has to do with being inundated with information."

In our survey, *Macworld* asked Mac, DOS, and Windows users whether computer use had increased their personal productivity; the vast majority of respondents agreed that it had. Then we asked them to consider this statement: "Because of my [computer] I actually spend more time working than I normally would." About half of all respondents agreed.

People work longer hours for many reasons. But as a rapid response to the

onslaught of E-mail, fax, and phone messages becomes an accepted standard, those messages make work seem more urgent than ever before.

Many Macintosh users attribute longer hours, in part, to the seductive hold of the GUI. The Mac is so easy and fun that "you find yourself making up reasons to use it," one enthusiast told me. He may be an extreme case. But like many consumer goods that start out as luxuries and rapidly become necessities, computing "conveniences" are a siren call that makes work seem more compelling.

The Mac is no worse—but no better—than other machines in this way. Yet it was created, in large measure, to overcome such computing pitfalls.

And developers seem to ignore

ry designer of QuickDraw, MacPaint, and HyperCard, "the real vision of the Mac [development] team was a very popular vision—as in populist." Did the Mac become a populist force for change in our society? To answer that question, let's start at the Mac's birth.

Priced to sell? Apple had originally hoped to sell the Mac for about \$1000. But by the time the Mac was released, it was way behind schedule and the Lisa had bombed, costing Apple millions. So company executives decided to squeeze more revenue out of the Mac. They

lations. Although there are many Pieter Folkens out there, there is no concrete evidence that such worthy ventures are any more prevalent among Mac users than they are for users of, say, IBM PCs. (Any major computer company can provide such examples.)

Moreover, an analysis on where Macs are used does not suggest any pronounced social or political influence. Apple sells just about wherever it can, as any Fortune 500 corporation must. But unlike its major competitors, Apple has consistently identified the Mac as a



Computing has stupendously reduced the cost of information. And job overload has to do with being inundated with information.

JULIET SCHOR

HARVARD UNIVERSITY ECONOMIST

chronic overwork and information overload as they attempt to push "empowerment" to new heights. The logical extension of the growing tendency by information-driven people to plug in constantly is precisely the vision that Apple presents for a society of PowerBook and Newton users: constant, instantaneous, intuitive, "intelligent" access to news, work, schedules, data, entertainment, messages, and all that goes with them—anytime, anyplace. A dream of empowerment? Certainly for some. For others, it seems more like a nightmarish electronic umbilical cord.

The Computer That Changed the World?

While the Mac has profoundly influenced personal computing, Apple has always suggested that the Mac has gone much further. "When [Apple employees] talk about changing the world and making a difference, you can bet they don't just mean changing the way we type letters or making a difference in our factories' output," according to an Apple publication. "They come to Apple because they sense a chance to do something important. Something historic." Independent Mac developers often echo these words.

According to Bill Atkinson, a prima-

ry designer of QuickDraw, MacPaint, and HyperCard, "the real vision of the Mac [development] team was a very popular vision—as in populist." Did the Mac become a populist force for change in our society? To answer that question, let's start at the Mac's birth.

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Good deeds Despite these less-than-populist decisions, many people believe that the Mac appeals more than other computers to the provocative, creative, social engineers who might be credited with pushing the world in a positive direction (meaning populist and socially liberal to the Mac's originators). Just as the many stories about how the Mac changed individual lives are true, certain people and groups have done great and influential things with the help of a Mac.

Environmentalist Pieter Folkens, for example, uses his PowerBook to digitize photos of endangered whale species. He then creates field guides to help fishermen in Madagascar identify whales and thereby contribute to research on whale popu-

force that would change the world.

The Mac's biggest corporate customers, however, feature major defense contractors (such as Lockheed and Martin Marietta), nuclear weapons labs (Lawrence Livermore and Rocky Flats), and financial institutions (J. P. Morgan, the World Bank)—hardly forces for popular social change in the rebellious image of the Mac's creators and marketers.

Although they acknowledge that the Mac isn't an exclusive tool of the idealists its creators envisioned, it still has changed the world for the better, those creators argue today. "Empowerment is not selective. You don't empower someone to do your agenda," Atkinson argues. "You make a tool. You try to design into that tool capabilities that you think people will use in a good way. But how people actually use the tool is really up to them. And I'm still [convinced] that more people were empowered to write their senators about something than were empowered to make bombs with it. People are basically good, and giving people power, in general, is a good thing to do."

Atkinson expresses a fundamentally democratic concept echoed in official Apple statements: Personal computing can help someone use powerful business tools, tap into vast libraries of informa-

The Macintosh Religion

The Macintosh has stimulated such devotion, such excitement, and such a firm belief in its importance among many users that it begs a question: Is there a Macintosh culture that embodies the populist ambitions of the Mac's creators?



The answer lies in the clubs known as Macintosh user groups, or MUGs, which arose almost from the moment the Macintosh shipped; there were about 1900 such user groups at last count. MUGs were formed because users wanted to help each other solve problems. "There was no Mac priest-

burgeoning Macintosh congregation. "For me, the Mac was the closest thing to religion I could deal with," notes a volunteer in the New York MUG, in a comment not atypical for a MUG volunteer.

Edward Mendelson, a professor of English literature at Columbia University and a contributing editor to *PC Magazine*, once compared Mac fanatics to devout Catholics and PC fanatics to devout Protestants. "Each thinks that it is itself the one hope for salvation," he wrote in the *New Republic*. "At one end of the scale is the ascetic stylite, who renounces the disorder of humanity to stare raptly at the screen. At the other end is the technological visionary, who rants endlessly about the utopia that will be ours when the computer comes into its kingdom."

original Macintosh development and marketing team. "We [were building] computers for ourselves and people like us. With the Mac, we wanted to expand our family. It's the same mechanism that religions use." Apple still calls its proselytizing marketing people evangelists. MUGs have always been churchlike—preaching to the converted, reaching out to whoever needed help. And like churches, MUGs offer a feeling of community. They have a populist spirit, but in a self-help sense rather than a social or political sense.

Unfortunately for Apple, using a religious approach to jump-start interest in the Mac may have backfired. Few computer users identify with the dogma of Mac worship. Says Gordon Eubanks, CEO of Syman-tec, "When Apple let the Mac

MACINTOSH DEVELOPMENT PIONEER CHRIS ESPINOSA: WE DID TRY TO CREATE THE RELIGIOUS EXPERIENCE

hood," explains Steve Costa, executive director of the largest Mac user group, based in Berkeley, California. But there was a

This phenomenon was no accident. "We did try to create the religious experience," says Chris Espinosa, a member of the

become a religious issue more than a tool, the consequence was high visibility and a lot of great press—but also a limited market."

tion, or even become an electronic Paul Revere. It can generate new hope in the most unlikely settings. Atkinson tells a story, for example, about a vacation he took in Jamaica. "I went out into one of the most remote rural areas," he explains with a grin growing across his face. "And there was a waterwheel driving a generator charging a battery. That battery was running a Macintosh that was doing graphics editing and using an Image-Writer with one of these thermal-transfer ribbons to make T-shirts!"

But the net impact of computing across the social landscape makes the "technology is value-neutral" argument look like a fuzzy corporate rationalization. By identifying the Mac with a vaguely liberal social agenda and promoting the Mac as a tool for change, Apple has implicitly supported the idea that thousands of waterwheel-powered Jamaican T-shirt companies offset the World Bank using its thousands of Macs to collect loan payments from Jamaica's struggling economy; or that a thousand letters to Congress urging a nuclear test ban outweigh the design of a new warhead.

It doesn't matter whether you support "peace through strength" or "no nukes." (Our survey, incidentally, suggests that the political affiliations and inclinations of Mac, Windows, and DOS users are virtually indistinguishable.) The real world-changing force that computers—including the "antiestablishment" Mac—offer lies in the hands of economic, political, and military heavyweights. Simply giving people a tool does not affect the balance of power. Even if every person in the world had a Mac, this would still be true.

The *Macworld* survey suggests that while today's Macintosh users believe the Mac did change the world, so do DOS users think DOS computers changed the world, and Windows users think Windows changed the world. But in all three cases, this is change in a minor key. The automobile altered society in fundamental ways; the automatic transmission did not. Similarly, computers changed the world; the Mac did not.

Shedding the Illusions

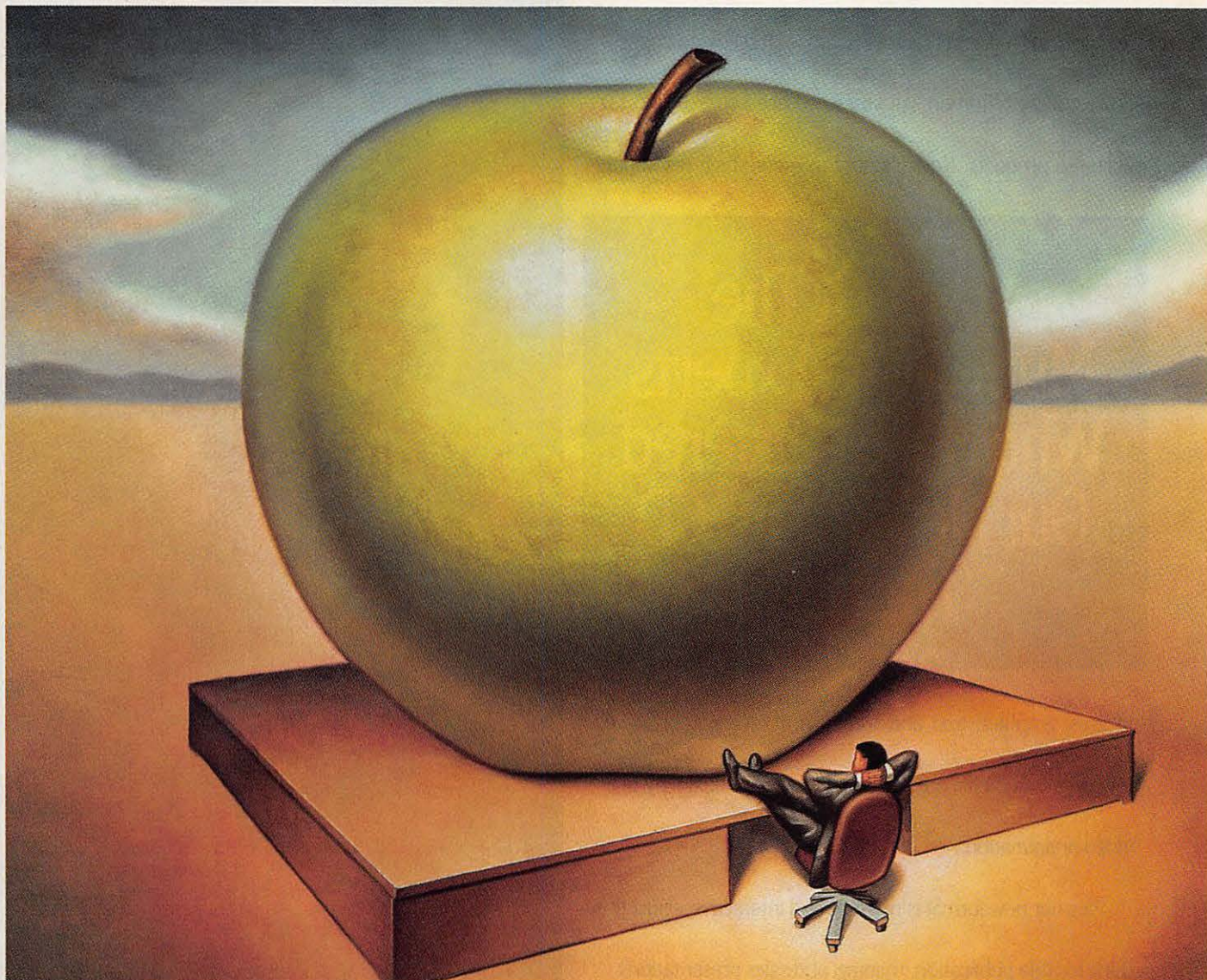
The grandiose Macintosh mystique once energized the people who created,

bought, and loved the Mac. Now those absorbed in the mystique have trouble distinguishing between what serves them well and what fails them. And many people are so put off by the extremist illusions that they never experience the Mac's engaging reality. That reality represents a remarkable technological vision, but too fervent a belief in the Mac clouds the vision. Recent ads and comments from Apple marketers suggest that even Apple is trying to move beyond the Mac mystique. It has begun to promote the Mac for what it really is—not our savior, not the pivotal technology of our times, not the key to a better life, but a smart choice to enhance your personal productivity and have some creative fun in the process.

The power to be your best? Occasionally. The power to escape the mundane? Often. Maybe that's enough for any computer. ■

Senior associate features editor CHARLES PILLER's most recent book is *The Fail-Safe Society: Community Defiance and the End of American Technological Optimism* (University of California Press, 1993).

Hewlett-Packard® suggests you look beyond the obvious for your next Mac printer.



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And a RISC processor means fast printing from start to finish.

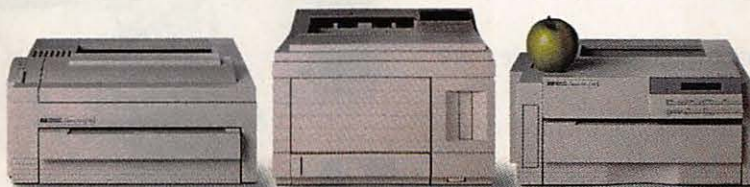
These printers have standard memory that ranges from 4 to 6 megabytes. That's plenty for your graphics. For documents with zip and zing, you'll have 35 built-in PostScript Type 1 typefaces. And, thanks to HP's automatic language and I/O switching, LaserJets work simultaneously with Macs and PCs. In fact, HP leads the industry in cross-platform compatibility.

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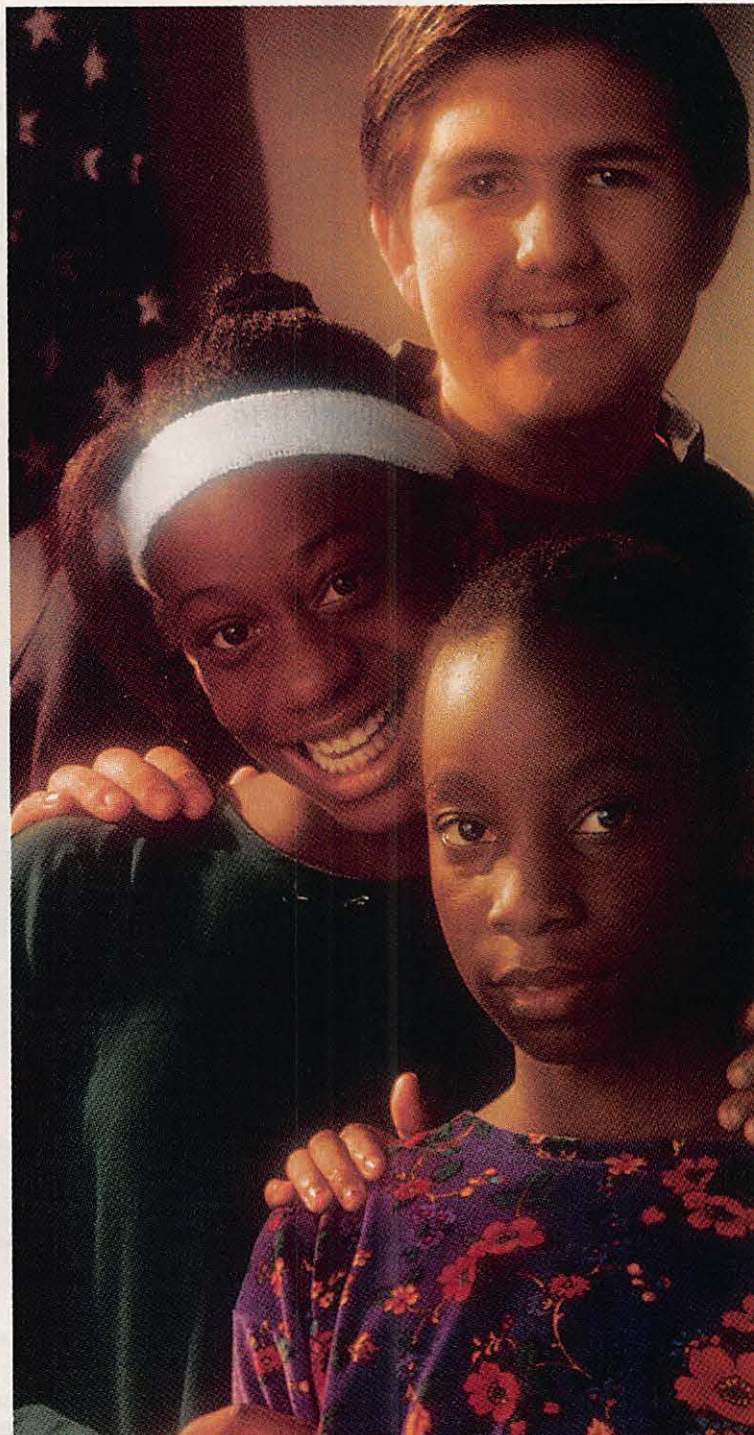
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And you'll soon be an expert, too.



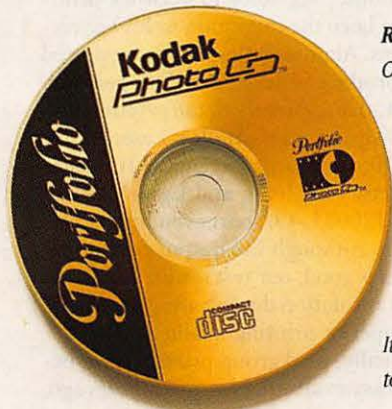
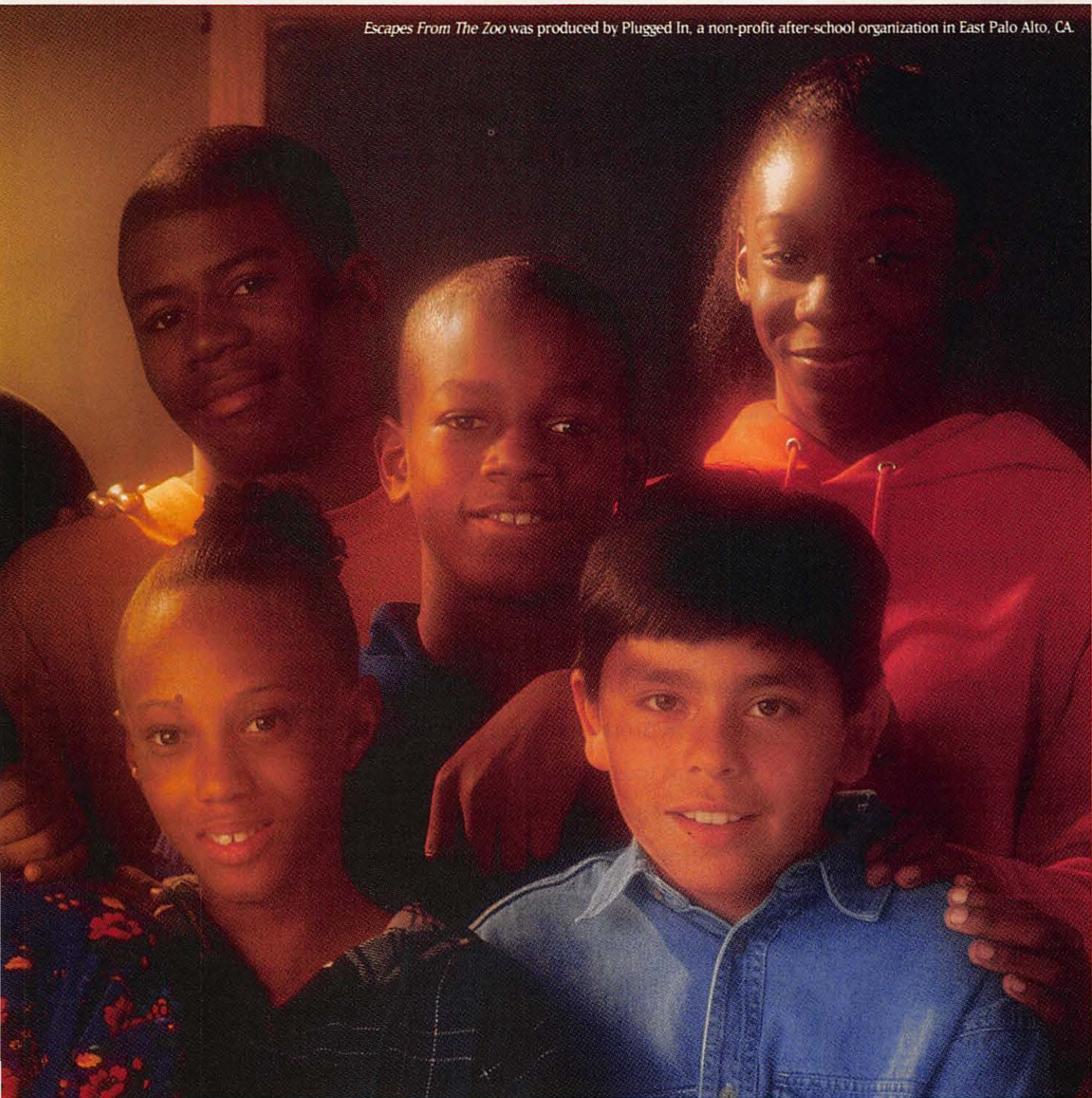
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Macworld Lab compares 16 high-speed printers

Workgroup

Network printing is the forgotten child of laser printers and network operating systems. It's much easier—and more glamorous—to talk about these two technologies separately. With networks, the hot topics include file sharing and servers; with printers, high-resolution output and faster engines. But the worlds of these two technologies do come together: ironically, networks were created with printer sharing in mind. ¶ Workgroups today demand a lot more from printers than mere device sharing. Besides providing faster throughput, network printers must distinguish between different jobs and sort them accordingly, notify network users when a job is done, and indicate when the printer is out of paper or low on toner. These devices must even remember where they left off on a job if they run out of paper while printing it. Printers such as the Data-

by Gene Steinberg products LZR2080 and the Compaq Pagemarq 20 come with multiple paper trays both to handle the extra load that workgroups create and to give users the option of reserving a tray or two for special paper like letterhead or legal-size paper and envelopes. Additionally, printers such as the NewGen Turbo PS/660B and the GCC SelectPress 600 accept ledger or tabloid (11-by-17-inch) paper. ¶ With multiple users, some of whom may have a computer other than a Macintosh, the printer needs to manage several jobs at once—and it may need to speak

Hewlett-Packard's PCL page-description language along with the standard Adobe PostScript or third-party PostScript emulation. Software innovations such as QMS's Crown Architecture and HP's autoswitching scheme help printers change between these page-description languages with relative ease. A big surprise this year is that Apple is joining the fray with its LaserWriter Pro 630 and 810, both of which have PCL emulation on their controller boards. Multiple ports adorn the back panels of the output devices reviewed here, with LocalTalk, Centronics parallel (for DOS and Windows PCs), and RS-232 serial being the most common. The printers we tested, with the exception of the Okidata OL850, also come with Ethernet either as an option or built in.

A new wrinkle in the multiuser, multiprotocol saga this year is Dataproducts' Virtual Printer Technology (VPT), which allows a network manager to create several profiles for a single printer, each offering different capabilities; for example, one might print on letterhead only (see "Virtual Printer Technology").

Another big story in network printing has been the migration to higher resolutions. Almost all the printers reviewed here produce at least 600-dots-per-inch output, thanks largely to the proliferation of 600-dpi engines. Apple's LaserWriter Pro 810, Compaq's Pagemarq 20, Dataproducts' LZR2080, and LaserMaster's Unity 1200XL-O, sport even higher resolution. Although the output from these devices is good, our test results show that higher resolution doesn't always translate into superior printing quality.

Finally, workgroup printers have become easy to afford. Not many years ago,

Clockwise from top: Hewlett-Packard LaserJet 4Si MX,
Compaq Pagemarq 20, and Apple LaserWriter Pro 630.

Printers



a 300-dpi, 8-pages-per-minute PostScript laser printer would set you back \$5000 or \$6000. The 12 Level 2 PostScript printers Macworld Lab tested cost from \$3500 to \$4000 on average, with the least expensive being the GCC Eclipse 8 at \$1799.

The Best of Both Worlds

Multiplatform networks used to give end users and network managers headaches. Switching between PCL and PostScript presented a problem: a Macintosh user would send jobs to a printer after a PC user had printed a job, and the Mac job wouldn't print. Or the Chooser wouldn't show the desired printer because you or one of your coworkers had failed to flip the correct DIP switch on the printer.

Today emulation switching isn't so bothersome, particularly if the PC users work in Microsoft Windows. Many of the printers here, such as the Compaq PageMarq 20 and the Dataproducts LZR2080, ship with Windows printer drivers. Many Windows applications speak PostScript,

too, so Mac and Windows users mostly work in the same page-description language. For networks whose PC users work only in DOS, however, automatic emulation switching has made switching between PCL and PostScript easier. With automatic emulation switching, the printer determines whether a file is PostScript or PCL and then switches to that emulation to print the document. The HP LaserJet 4M and 4Si MX, the LZR2080, and the Pagemarq 20 are among the printers offering this capability.

The printers we tested cope well with simultaneous LocalTalk and parallel connections. They accept the jobs on a first-come-first-served basis.

Apple's LaserWriter Pro 630 offers a different scheme. The printer's ports are all simultaneously active, so the 630 can, for instance, accept input through its EtherTalk and RS-232 ports. Also, each port is configured for a specific emulation—the EtherTalk and LocalTalk ports accept PostScript documents only, while

a network manager can configure the RS-232 or Centronics ports to accept PCL input. You can change this configuration at the rear of the printer using two push buttons, or you can use the Mac version of the printer utility software.

Two devices—the GCC SelectPress 600 and the Eclipse 8—don't incorporate emulation switching. Texas Instruments' MicroLaser Pro 600 and MicroLaser XL Turbo require that users change the emulation on the printer's control panel.

The Ethernet Connection

If you have a large network or print a steady stream of documents, consider a printer that offers Ethernet connections. Most of the printers here offer it as an option (\$300 to \$400) or as standard equipment. It's a good investment, particularly if many of your users print large documents or documents with multiple fonts or graphics. Of course, if you don't have a Mac Centris or Quadra, which have Ethernet as a standard feature, you



Testing Workgroup Printers

Best result in each category for each test. Times are in seconds. Shorter bars are better. Products are listed in order of overall performance for each category, from fastest to slowest.

300-dpi Printers

	Multiple Fonts	Single Font	MacDraw Pro	FreeHand 3.1	PageMaker 5.0	TrueType
QMS 1725 Print System	53	93	78	163	50	65
Compaq PageMarq 20	55	82	77	216	55	52
Hewlett-Packard LaserJet 4Si MX*	78	91	79	216	44	52
IBM 4039 16L*	96	97	93	376	56	78
Texas Instruments MicroLaser XL Turbo	115	92	108	420	70	71
QMS 860 Print System	86	175	94	351	60	83
Dataproducts LZR2080	121	84	97	448	76	92
Apple LaserWriter Pro 630*	126	160	113	421	109	63
Hewlett-Packard LaserJet 4M*	153	161	121	390	93	72
NewGen Systems TurboPS/660B*	154	260	132	641	88	60
GCC Technologies Eclipse 8*	143	214	166	591	194	106
Okidata OL850*	431	161	295	1817	144	256

400-dpi Printers

Compaq PageMarq 20	59	85	81	236	60	55
Dataproducts LZR2080	133	88	104	480	87	97

600-dpi Printers

Hewlett-Packard LaserJet 4Si MX*	88	92	79	241	52	53
Compaq PageMarq 20	62	85	94	303	66	56
Texas Instruments MicroLaser Pro 600	152	153	81	132	87	52
LaserMaster Unity 1200XL-O*	135	176	89	349	107	50
QMS 1725 Print System	122	264	78	203	95	116
QMS 860 Print System	98	175	98	418	85	91
GCC Technologies SelectPress 600	119	221	112	387	114	66
Lexmark IBM 4039 16L*	133	175	130	531	79	91
Apple LaserWriter Pro 630	154	163	124	503	124	71
Hewlett-Packard LaserJet 4M*	193	161	110	487	135	76
NewGen Systems TurboPS/660B*	179	290	170	1147	110	66

800-dpi Printers

Dataproducts LZR2080	210	112	117	650	137	112
LaserMaster Unity 1200XO*	234	184	200	573	162	102

*Printers were tested with image-enhancement features on.

may have to buy an Ethernet card for all the Macs on your network.

Ethernet is much faster than LocalTalk. Its data-transfer rate is 10 megabits per second, while LocalTalk's is 0.234 Mbps. Some companies might use LocalTalk to connect users to a printer with the idea of saving money; however, the time spent waiting for documents to print will probably offset any cost savings. Our testing showed that Ethernet outperformed LocalTalk by 10 to 30 percent—and this was on a one-to-one network (one machine, one printer). On a large network, Ethernet has a data-transfer rate that is about 400 percent faster than that of LocalTalk. In printing, the speed advantage is much lower since print speed is determined by the processors on the controller board inside the printer as well as the print engine. But when traffic is heavy—as it would be on a large network—Ethernet gives you more bandwidth to play with than LocalTalk.

PostScript's Stamp

Another boon to cross-platform printing is PostScript, a platform-independent page-description language. Adobe began shipping Level 2 PostScript in 1991, though Apple and Adobe didn't ship the printer driver for another two years. Of the printers *Macworld* tested, 12 have a Level 2 interpreter (see "Level 2 PostScript Explained"). All the printers—even models that offer only Level 1 PostScript—performed reasonably well with the Level 2 driver.

As a quick test of how the new driver affects printing performance, we ran the Apple LaserWriter Pro 630 and HP 4Si MX through our standard test suite twice, once with the Level 1 driver and again with the Level 2 driver. On complex documents, we saw an improvement of 12 to more than 30 percent. The 4Si MX was actually slightly slower with the Level 2 driver in our TrueType print test, but was otherwise faster overall.

We experienced no problems resulting from PostScript emulators like Microsoft's TrueImage or Phoenix Technology's PhoenixPage, and these clones offer no price advantage over a true Adobe PostScript device.

Few clone printers had any problems handling the text or graphics in the documents we used in our test suite. So users can concentrate instead on factors such as printing speed and resolution.

One caveat to purchasing a clone: as Adobe refines its PostScript software, the clones may need hardware updates. For example, QMS released a ROM revision to address problems in printing files created with Adobe Illustrator 5.0.

VIRTUAL PRINTER TECHNOLOGY

In a Macintosh-only network, printing is straightforward and uneventful thanks to an excellent printer driver from Adobe and Apple. Unfortunately, it is a different story on an enterprisewide network of heterogeneous systems that communicate in various protocols over one or more network architectures. Since few standards are available, printer sharing is usually less than efficient.

A primary concern of network printer users is that they don't know which emulation is active at a given time. Automatic switching between PostScript and PCL 5, while mostly reliable thanks to emulation-sensing technology, still occasionally fails to switch to the appropriate format.

Virtual Printer Technology (VPT), Dataproducts' proprietary technology for printer management in an enterprisewide network environment, is the most intelligent solution to date for solving problems associated with printing on a multiplatform network.

VPT allows a network manager to create up to 64 profiles for a single printer. These profiles are treated by the network as though they were real printers, and users can see and select them from the Chooser.

VPT is convenient for network managers because they can configure VPT-equipped printers (including the new Apple LaserWriter Pro 810) from a remote terminal. The 64 virtual personalities also help managers alleviate many small printing problems users face. One printer selection might be Virtual Printer Letterhead, which prints in portrait mode at 600 dpi in Apple EtherTalk protocol in PostScript format using paper from the letterhead tray. By selecting the appropriate virtual printer, the user can safely assume that the output will be in the expected format.

Another problem associated with network printing is the inadequacy of



some application drivers. For example, some older DOS applications support only a single paper tray, a 300-dpi laser printer, or even a lowly dot matrix printer. With VPT, different configurations are preset to take advantage of different

printing scenarios; all you need to do is select the virtual printer of choice in the network.

A future version of VPT will feature configuration authorization. Network managers can specifically authorize access to a certain group of users and exclude others. For instance, a manager can force a group of users who often print large documents to print to the profile for a recycled-paper printer to help cut supply costs. A manager can also set print-queue priorities so that, for example, the boss never has to wait in line to print.

VPT will eventually include resource accounting. This will give a network manager information on the total resource consumption for each user. The network manager can then decide whether to charge departments or users for paper, toner, and general printer use. The manager can also use the information to intelligently plan future network expansion.

Another planned feature is the ability to save the context of each virtual printer. For instance, certain users or workgroups may require certain downloadable fonts or electronic forms to be resident in the printer throughout the day. By saving that information along with the emulation settings and paper tray and resolution information, there will be no need to resend the information every time the printer configuration changes.

To most users of a Mac-only network, VPT might not mean much. However, for anyone managing or using an enterprisewide network, VPT represents a big improvement.—Mark Hurlow

Is It the Engine or the Controller?

Workgroup printers commonly advertise engine speeds of 8 to 20 ppm. If you are printing simple documents with one or two resident fonts, or multiple copies of the same document, you might actually achieve those speeds. But when your document includes multiple down-

loadable fonts, complex art, and halftones, you need to look at how efficiently the controller crunches data to build a page. Fortunately, printers with high-speed engines tend to have high-powered RISC processors.

Workgroup printers may offer other features to speed up performance, too.

Surveying Workgroup Printers

Company	Product	Phone	Toll-Free Phone	List Price	Maximum Engine Speed (in ppm)	Engine Manufacturer	Best Resolution (in dpi)	PostScript Level
Apple Computer	LaserWriter Pro 630	408/996-1010	800/776-2333	\$2529	8	Canon	600 x 600	2
	LaserWriter Pro 810	408/996-1010	800/776-2333	\$4899	20	Fuji/Xerox	800 x 800	2
Compaq Computer	Pagemarq 20	713/378-8820	800/345-1518	\$3599 ^A	20	Fuji/Xerox	800 x 400	2
Dataproducts	LZR2080	818/887-8000	800/334-3174	\$4995-\$5495	20	Fuji/Xerox	800 x 800	2
GCC Technologies	Eclipse 8	617/275-5800	800/422-7777	\$1799	8	Okidata	300 x 300	2
	SelectPress 600	617/275-5800	800/422-7777	\$4499	8	Toshiba	600 x 600	2
Hewlett-Packard	LaserJet 4M	○	800/752-0900	\$2399	8	Canon	600 x 600	2
	LaserJet 4Si MX	○	800/752-0900	\$5499	17	Canon	600 x 600	2
LaserMaster	Unity 1200XL-O	612/944-9330	800/950-6868	\$8995	8	Toshiba	1200 x 1200 ^B	1
Lexmark International	IBM 4039 16L	○	800/426-2468	\$3399	16	Lexmark	600 x 600	1
NewGen Systems	Turbo PS/660B	714/641-8600	800/756-0556	\$4995	8	Canon	600 x 600 ^C	1
Okidata	Okidata OL850	609/235-2600	800/654-3282	\$1999	8	Okidata	300 x 300	1
QMS	860 Print System	205/639-4400	800/523-2696	\$4595	8	Canon	600 x 600	2
	1725 Print System	205/639-4400	800/523-2696	\$4999	17	Canon	600 x 600	2
Texas Instruments	MicroLaser Pro 600	○	800/527-3500	\$2198	8	Sharp	600 x 600	2
	MicroLaser XL Turbo	○	800/527-3500	\$3649	16	Sharp	300 x 300	2

● = yes; ○ = no. Technical-support ratings are based on a series of calls made to each company by Macworld staffers (posing as customers) to gauge the accessibility, helpfulness, and we call only those companies whose products Macworld Lab tests. ^A Estimated street price, base configuration. ^B Manufacturer's claim. ^C Upgradable to 1200 by 600 dpi for

LEVEL 2 POSTSCRIPT EXPLAINED

In 1991, manufacturers of PostScript printers discovered a new buzzword—*Level 2 PostScript*. It took another couple of years for Adobe and Apple to finally release a printer driver to support this new version of the PostScript page-description language.

The new PostScript improves most aspects of document processing, especially on printers designed to take advantage of Level 2.

The biggest change you'll see is the use of custom PPD (printer page description) files, which let you customize the driver to the requirements of your printer. For example, you can turn image-enhancement features on and off, switch printer-resolution settings, and switch paper trays. In most applications, these changes can be made from the Print dialog box.

Level 2 boosts background printing speed between 10 and 30 percent. Also, PostScript's memory-management techniques now allow the printer's CPU to tap memory from a single memory pool (rather than divide it for separate chores, as is done with Level 1); this should reduce out-of-memory messages when you print documents.

The current Level 2 drivers do have a few drawbacks. There are some com-

patibility problems with older applications that are documented in the Read Me files from Adobe and Apple. Also, printing is a two-pass process, which doesn't help speed up document processing if you prefer to work with background printing inactive.

Some of the promised Level 2 enhancements didn't make it into the first releases of the software; for example, there is no forms-and-pattern-caching, which would allow data describing a form or pattern to be stored in the printer's RAM for rapid reuse. Other features, such as on-the-fly compression and decompression of documents, require updates to the application from which you are printing.

Many of the newest printers ship with the Level 2 driver. Adobe includes the new driver software with its CD-ROM versions of Illustrator 5.0, the Type On Call 3.0 CD ROM, and Acrobat. Apple distributes LaserWriter 8.0 on AppleLink and the major online services. Aldus includes LaserWriter 8.0 with PageMaker 5.0 (which requires the Level 2 driver to print properly), and Frame Technology includes the driver with FrameMaker 4.0. The drives can be purchased separately with manuals for \$24.95 from Adobe and Apple.

For instance, using QMS's Crown Architecture, the QMS 860 and 1725 Print System printers employ a multitasking scheme that divides the information on the page into compressed blocks of data instead of dealing with the entire page in a single step. According to QMS, this method allows the printer to compile the elements of the page, rasterize it, and hold the data in RAM until the printer is ready to output the document. This processing can continue even as another page is being printed. And if the paper runs out or jams, you can print the missing pages without resending the entire job.

HP's 4Si MX printer uses a PostScript job-overlap feature that begins processing a second document while the first is printing. Multiple frame buffers allow the printer to process a PostScript job while a PCL job prints or vice versa. For larger, more complex network setups, this scheme will automatically switch between multiple network operating systems. The impact of these technological goodies showed up in our lab tests, where the 4Si MX processed 600-dpi documents (with four times as much data) at a speed close to that of the faster 300-dpi mode.

Two of the high-power clone printers, NewGen's Turbo PS/660B and LaserMaster's Unity 1200XL-O, did not perform well in terms of processing pages. LaserMaster's TurboGray feature produced nice-looking halftones and grayscale art, but it took a sizable toll in speed: it was 108 seconds slower at printing a

Manufacturer of PostScript Interpreter	TrueType Rasterizer	RAM (base model/maximum)	All Ports Active/Emulation Switching	SCSI Port for Font Hard Drive	Ethernet	Standard Paper Tray Capacity (in sheets)	Maximum Paper Size (in inches)	Tested	Technical-Support Rating
Adobe	●	8MB/32MB	●/●	●	built in	250	8.5 × 14	●	acceptable
Adobe	●	8MB/16MB	●/●	●	built in	3 trays (250 each)	11 × 17	○	acceptable
Adobe	●	4MB/20MB	●/●	● (built in)	built in	3 trays (500 each)	11 × 17	●	acceptable
Adobe	○	8MB/32MB	●/●	●	optional	3 trays (250 each)	11 × 17	●	poor
Phoenix Technology	●	2MB/6MB	●/○	○	built in	250	8.25 × 14	●	acceptable
Phoenix Technology	●	8MB/16MB	●/○	● (built in)	built in	250	11 × 17	●	acceptable
Adobe	○	6MB/32MB	●/●	○	optional	2 trays (100/250)	8.5 × 14	●	poor
Adobe	○	10MB/26MB	●/●	○	built in	2 trays (500 each)	8.5 × 14	●	poor
Microsoft	●	32MB/48MB	●/●	●	built in	250	12 × 19.5	●	unacceptable
Phoenix Technology	○	4MB/16MB	●/●	○	optional	500	8.5 × 14	●	unacceptable
Weitek	○	12MB/96MB	●/●	●	optional	250	11 × 17	●	unacceptable
Adobe	○	2MB/4MB	●/● ^o	○	○	200	8.5 × 14	●	unacceptable
QMS	○	12MB/32MB	●/●	●	optional	2 trays (250/100)	11 × 17	●	unacceptable
QMS	○	8MB/32MB	●/●	●	optional	2 trays (500 each)	8.5 × 14	●	unacceptable
Adobe	●	6MB/22MB	●/●	○	optional	500	8.5 × 14	●	poor
Adobe	○	2.5MB/10.5MB	●/●	○	optional	200	8.5 × 14	●	poor

and accuracy of the company's support technicians. Macworld uses a point system, including bonuses and demerits, to derive the final rating. Ratings are for companies, not individual products, \$649. ^o Accomplished by software.

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Comparing Output Although there is a vast difference in quality between output from a Linotronic 2400-dpi film-image device used in service bureaus (left), and "imagesetter-quality" output from devices such as the LaserMaster Unity 1200XL-O (middle), the 1200-dpi output from the LaserMaster printer is barely distinguishable from the HP LaserJet 4M at 600 dpi (right.).

FreeHand 3.1 document than the HP LaserJet 4Si MX on average (see "Testing Workgroup Printers").

Our tests showed no significant speed improvements when we doubled the memory in a representative set of printers. In theory, it should speed up the printing process—and it does when you need to print a wider area on a page, handle a larger paper size, or download more fonts directly to the printer before beginning a job. But generally, you can function perfectly well with the RAM that comes with these printers.

Tell Me, How Does It Look?

Above all, the printers reviewed here make your documents look good. Devices like NewGen Systems' Turbo PS/660B can output true 600-dpi documents that look great to the naked eye.

The phrase "true 600-dpi output" means the engine itself is capable of printing 600 dots per inch horizontally and

vertically. Many manufacturers are making 600-dpi engines these days—Canon, Fuji/Xerox, Lexmark, Sharp, and Toshiba among them. Some printers are capable of more than 600 dpi, but this isn't always accomplished by the engine. Software instructions incorporated into a printer's firmware help interpolate the output, in effect making a 600-dpi printer simulate the higher output. Such a scheme is used by LaserMaster as part of its TurboRes technology. But despite its claim of being a 1200-by-1200-dpi printer, the Unity 1200XL-O turns out to produce 1200-by-600-dpi output, according to our inquiry of the printer's PostScript specifications.

With a few exceptions, for example, the Compaq Pagemarq 20, the text output of the various high-resolution models was surprisingly similar in quality. The 1200-dpi Unity 1200XL-O was barely distinguishable from 600-dpi products in text output (see "Comparing Output"),

although its graphics performance, particularly with the TurboGray feature enabled, was very good.

In judging output quality, we ignored small differences. Reproduction may become fuzzier as toner is spent, and

you might notice minor variations in output density as you switch from one toner cartridge to another. Paper quality also affects output quality.

Halftone performance was another story. Many of the printers, even those using image-enhancement techniques, such as the HP LaserJet 4M, showed noticeable banding on gray-scale images. This effect was especially visible on blends, images showing a gradual increase in shade. The GCC SelectPress 600 and the LaserMaster Unity 1200XL-O reproduced this sort of image surprisingly well.

Getting Up and Running

Setup for most of these printers is relatively easy and straightforward, but should you need a hand, some manufacturers, such as HP, include a card containing printer setup shortcuts and information about status displays.

While the other printers we tested include on-board displays and switches, the LaserWriter Pro 630 is limited to four side-mounted status lights that indicate processing status, when toner is low, when the printer is out of paper, and whether there's a paper jam. Several

BEHIND OUR TESTS



Macworld Lab used several real-world documents designed to show printer speed and, to a lesser extent, the computer's ability to handle various printing tasks (see "Testing Workgroup Printers"). A faster computer like the Quadra 800 or 840AV would have yielded faster results than those shown by our test machine—a Centris 650 with 8MB of memory and an internal Quantum 230MB hard drive.

We used System 7.1 and the new LaserWriter driver, version 8.0, for our testing. We used the PPD files supplied with the printers. Background printing and spooling were inactive.

To assess print quality, we examined the output with the unaided eye as well as with an 8X magnifying loupe. We checked how well each machine printed solid areas, and we looked for jagged type edges in larger sizes, filled-in characters in small sizes, and differences in gray-scale capabilities. We also printed the same file to a Linotronic imagesetter for comparison.

We also examined how a couple of representative printers handled printing on a peer-to-peer EtherTalk network versus how they performed on a peer-to-peer AppleTalk network. We also repeated our speed tests on a couple of printers using LaserWriter driver 7.1.1 instead of 8.0 to determine the performance improvement of the new driver.—**Macworld Lab testing supervised by Mark Hurlow and Danny Lee**

printers, such as the Pagemark 20, have a control panel on the front with a digital display and buttons you can use to configure and set up the printer. Others, like the LaserWriter Pro 630, can be configured with utility software. Apple's printer accessory kits deserve special praise because they include installation disks for Mac and Windows along with a single manual that makes setup easier.

Laser printers tend to be reliable products, seldom needing maintenance other than replacing toner and adding paper. But when you need support and

service, you're better off getting it from your dealer. No vendor that we tested received a technical-support rating higher than acceptable. Dataproducts (which outsources its technical support and took several days to answer our questions), Texas Instruments, and—the big surprise—HP all received a rating of poor. If you choose a model from a company that gives poor technical support, it would be a good idea to find a dealer with a reputation for good service after the sale.

The Envelope, Please

Overall, most of these printers performed decently in our tests. One exception was the Okidata OL850, which scored near the bottom of the list in virtually all tests, with slow performance and below-average print quality.

On the upside, the HP 4Si MX garnered the top rating for high-speed printing. But if you need 11-by-17-inch paper capability, the Compaq Pagemark 20 is an ideal choice—that is, if you don't mind its less-than-stellar output quality. The engine moves the paper through so fast that the toner smears a bit, leaving specks of toner on the page along with your type. We recommend that you also take a look at Dataproducts' LZR2080, GCC Technologies' SelectPress 600, and QMS's 860 Print System, all of which offer reasonably high-caliber printing and tabloid-paper capability but have somewhat slower output speeds.

In addition, you should consider the new Apple LaserWriter Pro 810. Apple licensed the Dataproducts LZR2080 printer to use as the basis for the 810, so the two are essentially the same. As with the LZR2080, the 810 uses Virtual Printer Technology.

If you want to produce a tabloid page with crop marks, your only choice from this lineup is the pricier LaserMaster 1200XL-O, which accepts 12-by-19.5-inch paper and thus can print an 11-by-17-inch spread with crop marks. But it exacts a hefty price: \$8995, about \$4000 to \$5000 more than printers that just use 11-by-17-inch paper.

If your needs are more modest, the best price/performance contenders are the Apple LaserWriter Pro 630 and the HP LaserJet 4M. They rated so close in performance that you could choose solely on features. The Apple printer is software controlled, with superior status displays and better manuals. Network managers can set up the Hewlett-Packard model through a convenient set of push-button controls on the front panel—despite the less-than-readable instructions HP provides. Both printers provide good-quality text and graphics reproduc-

tion. The HP 4M's text reproduction may be somewhat cleaner with Resolution Enhancement Technology active, and the Apple printer's graphics reproduction is slightly better.

None of these printers represent new, innovative technology, just a gradual refinement of controller, engine, and toner designs to give you better performance at lower prices than older models. While we can probably expect even higher-resolution output and speedier printers over the next year, at progressively lower prices, you can be assured that this crop of workgroup printers will offer reliable performance for years to come. **m**

GENE STEINBERG spends a lot of time on America Online (as AFA GeneS) helping harried Macintosh users solve their problems. He also contributed several chapters to David Pogue and Joseph Schorr's *Macworld's Macintosh Secrets* (IDG Books Worldwide, 1993).

WORKGROUP PRINTERS



We evaluated 16 workgroup printers and came up with 3 favorites. Our decision is based on overall performance and value.

High-Speed Printing

Hewlett-Packard LaserJet 4Si MX The 4Si MX combines high speed, efficient operation, and very good output quality to edge out last year's Editors' Choice ("Workgroup Printers," January 1993), the Compaq Pagemark 20, as the best all-around performer among the high-speed devices. **Company:** Hewlett-Packard. **List price:** \$5499.

Price/Performance

Apple's LaserWriter Pro 630 Part of a 600-dpi tandem we selected as the best buys, the LaserWriter Pro 630 has good-quality output and decent speed. It also provides better graphics performance than the LaserJet 4M. **Company:** Apple Computer. **List price:** \$2529.

Hewlett-Packard LaserJet 4M The other half of the tandem, the LaserJet 4M also offers high-quality output and good performance. But it gets the nod over the LaserWriter Pro 630 in the area of type quality. HP's Resolution Enhancement Technology provides slightly sharper text output at 600 dpi. Either printer is a good choice, however. **Company:** Hewlett-Packard. **List price:** \$2399.

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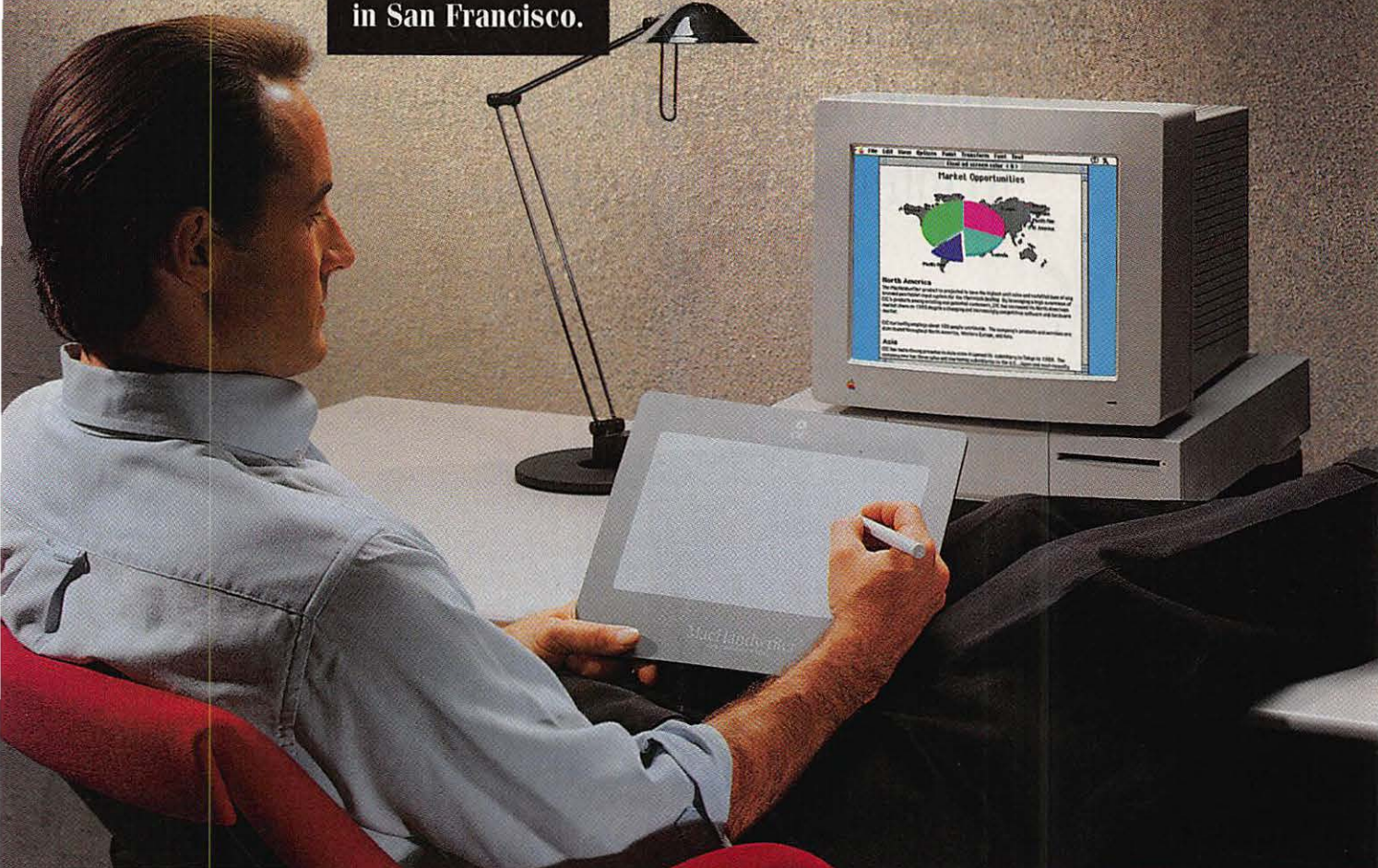


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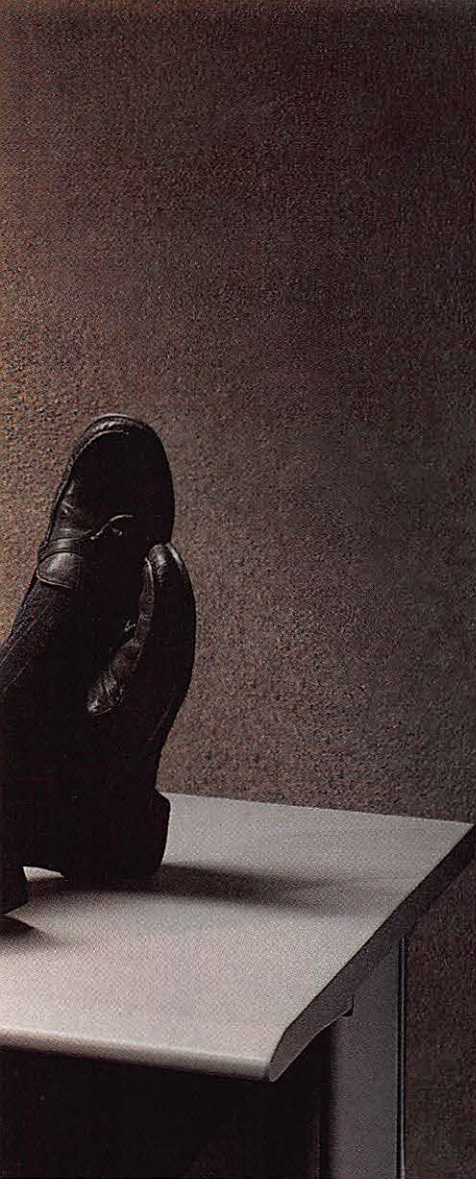
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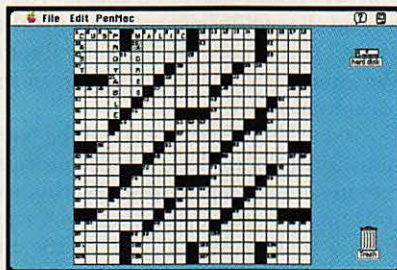
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Circle 31 on reader service card

EDITED BY JAMES A. MARTIN

Graphics

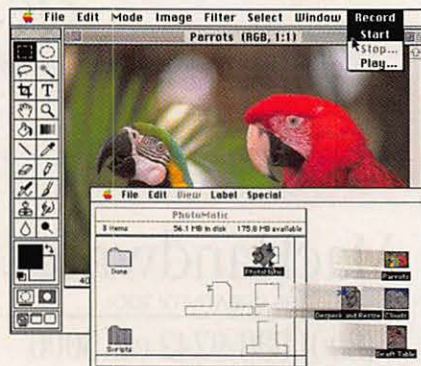
THE LATEST IN DESIGN, PUBLISHING, AND PREPRESS

Products for Powering Up Photoshop

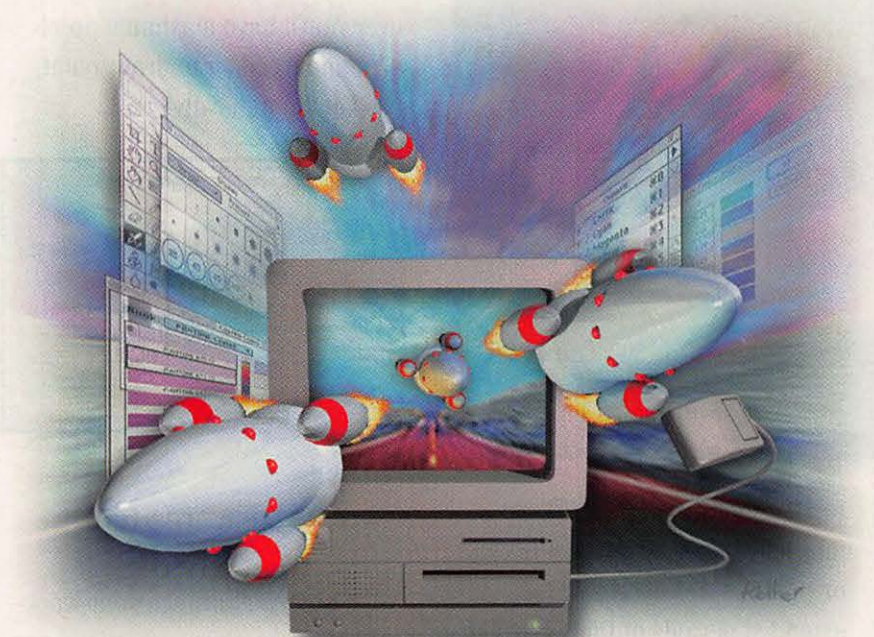
GRAPHICS PROFESSIONALS HAVE HAD to contend with often achingly slow performance in Adobe Photoshop since the image-editing application was first released. But there's a growing number of hardware and software products available for accelerating and enhancing Photoshop functions, filters, and tasks. Among the most recent product announcements are the following:

- DayStar Digital has announced its Photoshop Automation Technology (PAT), which uses AppleScript to automate and batch-process repetitive, time-consuming Photoshop functions.

DayStar's entry-level product using this technology, PhotoMatic (\$279; due to ship December 15), consists of three modules—PhotoLocal, PhotoRemote, and PhotoWatcher—plus a PhotoMatic extension, which lets you record any number of Photoshop manipulations as they're performed and save the script, or "recording," which you can play back and apply to other images. PhotoMatic recordings can be used as is, or edited with AppleScript.



DayStar Digital's PhotoMatic lets you automate Photoshop functions by adding a special menu to Photoshop for recording your actions (rear). To apply a recording, drag and drop it—along with the images being edited—to the PhotoMatic icon (front).



JOSEPH KETTER/ RADICAT DESIGN

PhotoLocal lets you apply any recordings to any of your images simply by dragging the appropriate recordings and image files onto the PhotoMatic icon. PhotoRemote performs the same functions as PhotoLocal, but it enables you to offload all your image processing to other Macs on the network as well. PhotoWatcher lets you run recordings in the background.

PhotoMatic Remote has all the functionality of PhotoMatic but also provides remote-control capabilities, allowing you to launch Photoshop and record scripts from a remote Mac as well as use any resources on the remote Mac. All the work is done in the original high-resolution files on the remote machine, while you see a low-res version of the process on your Mac. (At press time, pricing for PhotoMatic Remote had not been deter-

mined; it's due to ship in the first quarter of 1994.) DayStar Digital, 404/967-2077, 800/967-2077.

- Adobe's AV DSP Power Plug-in, for the AV Macs, speeds up Photoshop 2 to 7 times by sending 18 filters and functions—including Unsharp Mask, Gaussian Blur, and RGB-to-CMYK conversions—directly to the AV Macs' digital signal processor (DSP). Due to ship by the end of 1993, the plug-in will come free with Photoshop 2.5.1 and will be available to current 2.5 and 2.5.1 users for a \$10 shipping and handling fee. Adobe Systems, 408/986-6555 international; 800/642-3623 in the United States, 800/648-2846 in Canada.

- RasterOps said it would begin shipping its Horizon 24 QuickDraw accelerator and dual-DSP graphics subsystem in December. Horizon 24 features a 32-pin

ASIC dedicated exclusively to accelerating QuickDraw routines and tasks, and a memory buffer, expandable up to 256MB, for offloading large graphics files from your Mac's memory for faster processing. The board also includes a 128-bit data path for improved image access and processing speeds, and twin 66MHz AT&T 3210 DSP chips for accelerating Photoshop functions and filters.

The Horizon 24 is compatible with Apple Real Time Architecture (ARTA), which enables it to speed up QuickTime, 3-D modeling, animation, and other tasks. It supports resolutions up to 1280 by 1024 pixels on a 21-inch monitor in 24-bit color; includes hardware pan and zoom; and will be available in three memory configurations: 4MB, 16MB, and 64MB. Prices weren't final at press time but were expected to range from \$5000

to \$15,000, depending on the RAM configuration. RasterOps, 408/562-4200, 800/729-2656

- Radius's new multiprocessor card (at press time code-named T2) supports an optional twin AT&T 3210 DSP daughterboard. The DSP card replaces the SCSI-2 accelerator that ships standard with the T2 board. The T2 and the DSP card are expected to be available in January; pricing for the daughterboard should be under \$1000 but wasn't final at press time. For more information on the T2, see "Radius Rocket: The Next Stage," *News*, in this issue.

- SuperMac has announced its Thunder IIGX 1360 (\$4499), which offers QuickDraw acceleration and twin DSPs. For more information, see "SuperMac's Prepress Display," in this section.

—CATHY ABES AND J.A.M.

Lumina's Scanner/Digital Camera

L EAF SYSTEMS HAS ANNOUNCED THE Lumina, a 36-bit color input device that performs the duties of a flatbed scanner, a 35mm transparency and film scanner, and a digital camera for capturing three-dimensional objects. With its flexibility, relatively low price (\$6900), and ability to capture high-resolution images, the Lumina is designed for advertising agencies, catalog publishers, corporate communications offices, and others who have a variety of scanning tasks.

The Lumina includes a 2700-element, single-pass, trilinear charge-coupled device (CCD) array with a maximum resolution of 2700 by 3400 pixels. The device fastens to any tripod or copy stand and accepts Nikon bayonet mount lenses (not included) for capturing images. You can scan transparencies using an off-the-shelf slide illuminator or placing the slides on a light box, or scan a roll of 35mm film using an off-the-shelf automatic film feeder.



Leaf Systems' Lumina combines the capabilities of a digital camera with a flatbed scanner.

The software provided with the Lumina is an Adobe Photoshop plug-in that lets you resample 36-bit images to 24 bits; preview; crop; select image height, width, and resolution; and adjust the gamma. The Lumina is expected to be available in January. Leaf Systems, 508/460-8300, 800/685-9462.—J.A.M.

SuperMac's Prepress Display

B Y COMBINING SUPERMAC TECHNOLOGY's PressView 21 Display System with its 24-bit Thunder II GX 1360 QuickDraw acceleration and DSP card, graphic designers and prepress operators can work in Adobe Photoshop's CMYK mode as easily as in RGB mode, according to SuperMac. Users will also spend less time scrolling and zooming around page layouts, thanks to the monitor and card's support for a 1360-by-1024-pixel viewing area.

Most graphics professionals work in Photoshop's RGB mode, then convert to CMYK for final output, because CMYK mode severely taxes the Mac's processing power. According to SuperMac, the Thunder IIGX 1360 (\$4499) is the only QuickDraw graphics accelerator card with an ASIC that also supports CMYK processing on the fly. (For other DSP announcements, see "Products for Powering Up Photoshop," in this section.)

The IIGX 1360 includes two 80MHz AT&T 16A DSP (digital signal proces-

sor) chips. The DSPs accelerate such Photoshop functions as RGB-to-CMYK conversion and Resize, and speed up Photoshop filters including Sharpen More, Sharpen Edges, Gaussian Blur, and Despeckle. The Thunder IIGX 1360 ships with Apple's PhotoFlash (see *Graphics* news, January 1994) and Kai's Power Tools 2.0.

PressView (\$3999) is a 21-inch monitor that is based on a Hitachi tube and offers a variety of resolutions up to 1360 by 1024 pixels. The display system is bundled with the SuperMatch Display Calibrator Pro, which measures gamma and white-point temperatures to ensure color consistency between the monitor and the intended color output. SuperMac's display hood, also included, shields the monitor from glare. PressView also offers a number of software controls, such as the ability to adjust the monitor's white point. Both PressView and Thunder IIGX 1360 were expected to ship in November. SuperMac Technology, 408/541-6100, 800/541-7660.—J.A.M.

IN BRIEF

- **ColorSync 2.0** Apple's update to its color-management system includes support for PostScript Level 2, EPS and TIFF profile tagging, integration within QuickDraw GX, and improved cross-platform color profiles, among other features. ColorSync 2.0 should be available to developers in early 1994, with products incorporating it available later in the year.

- **Quick Quark Update** Fast on the heels of QuarkXPress 3.2 comes QuarkXPress 3.3, which lets you create text boxes in polygons and other shapes, directly import JPEG-compressed files, and automatically add spot colors from imported EPS files to the Color scroll list (for easily adding color to type and other elements). No charge to QuarkXPress 3.2 owners; upgrade from 3.1 is \$195. 303/344-3491, 800/788-7835.

- **3-D Design** Strata StudioPro (\$1495), now shipping, offers sophisticated spline-based modeling and animation functions that enable you to Explode, Shatter, and Atomize objects, among other things. You can also edit and manipulate objects in preview mode. 801/628-5218.

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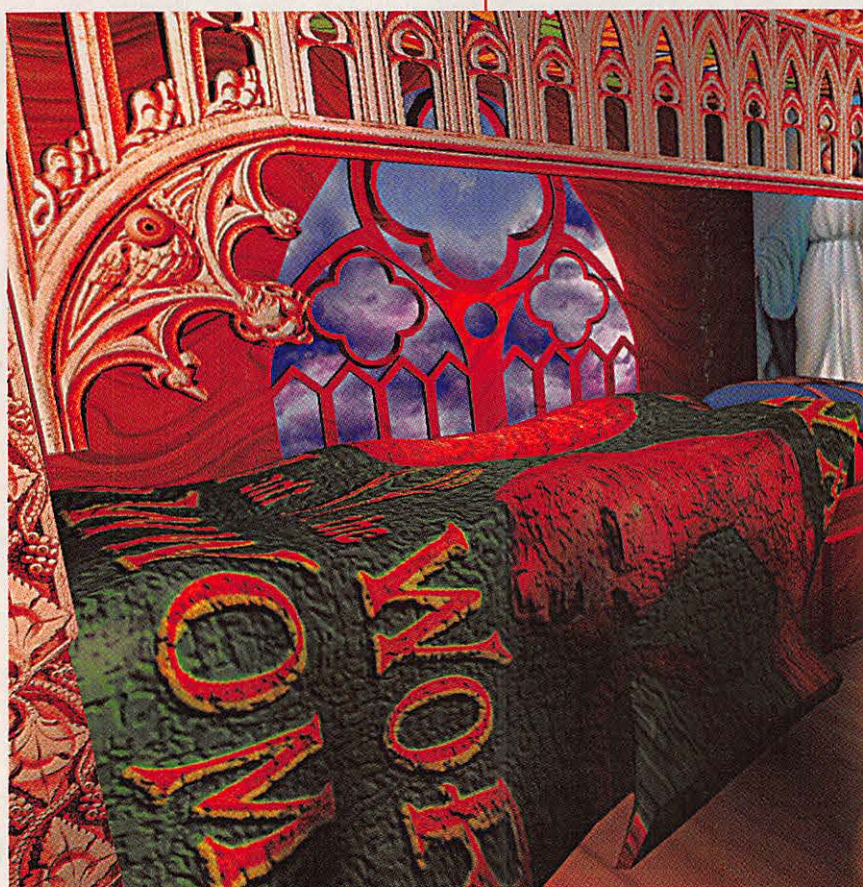
by Cathy Abes

Artist: Jim Ludtke is a San Francisco-based 3-D artist and animator whose illustrations have appeared in such publications as *Macworld*, *MacUser*, *Wired*, and *Newsweek*. He has created animations for such clients as Nintendo, Nickelodeon, and The Voyager Company.

How It Was Done: This image is one view of a room Ludtke created for *Freak Show*, a 3-D interactive CD-ROM by the performance group The Residents. The CD-ROM allows you to navigate the complex 3-D environment—made up of hundreds of Macromedia Director and QuickTime movies—exploring the inner sanctums of the various strange characters that inhabit *Freak Show*. This scene shows the inside of Wanda the Worm Woman's trailer, which the artist envisioned as a dark, Gothic habitat.

Working from a rough pencil sketch, Ludtke created all the elements of the room in MacroModel. First he built the shell of the room—the walls and floor—and used that as a template for building and placing the other objects. Once he finished an object, Ludtke deleted the walls and floor, and saved the result as a new file. For each object, he duplicated the shell template and followed the same building process. The room was made from these 15 to 20 files, which were exported to Swivel 3D format and then imported into ElectricImage. Ludtke prefers MacroModel to other modelers because it allows you to save each object's location in space with a high degree of accuracy. Once an object was imported into ElectricImage, its location stayed the same relative to all the other objects.

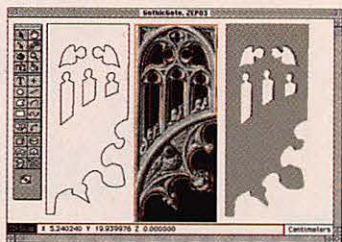
After texture-mapping, rendering, and animating the objects in ElectricImage and specifying camera movements, Ludtke imported the animation files into Director, and converted them from their original 24-bit to 8-bit format. On various sections of each animation file, he placed invisible buttons that when clicked would jump the user to a preset point in the score, to a particular frame in a movie, or from one movie to another. **m**



THE TOOLS

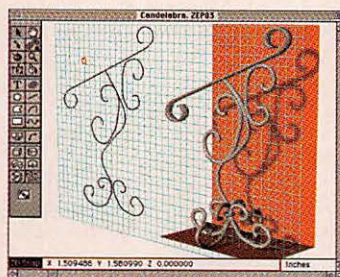
Hardware: Quadra 900 with 52MB of RAM and a 650MB internal hard drive; Micro-net 44MB removable-cartridge drive; Hammer 650MB removable rewritable-cartridge drive; Hammer 1000FMF 1GB hard drive; CD Technology CD-ROM drive; SuperMac Digital Film video-capture board for NTSC output; E-Machines 16-inch RGB monitor; Apple 13-inch RGB monitor.

Software: MacroModel 1.5; Swivel 3D Professional 2.0.4; ElectricImage Animation System 1.5; Macromedia Director 3.1; Paco Producer Pro 2.0; Adobe Photoshop 2.5; QuickTime 1.6.1.

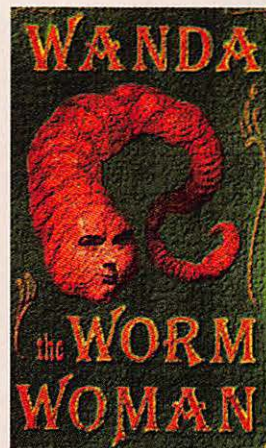


1 Ludtke scanned the ornate Gothic trellis from a copyright-free photo; in Photoshop he enhanced it, saved it as a PICT file, and imported

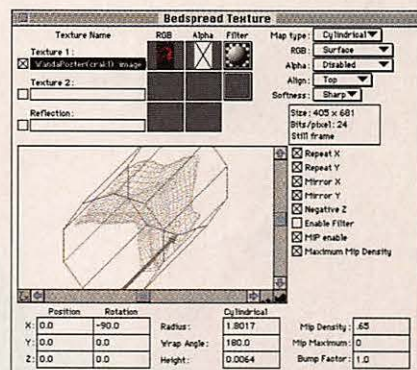
it into MacroModel. With the polyline tool he traced the trellis, then duplicated and selected all the lines that made up the shape, and extruded the object. The result was a 3-D object aligned to the scanned artwork. The final PICT file was traced and rendered onto the 3-D model.



2 Ludtke used MacroModel's spline tool to draw the curved lines of the wrought-iron candelabra (left). Next, he drew a small circle with the circle tool (shown in red), duplicated it, then used the path extrude tool to extrude the circle along a spline path; he repeated this process for each spline to make the three-dimensional candelabra. He then exported the model as a Swivel 3D file and imported it into the ElectricImage scene.



3 The texture map Ludtke used for Wanda's bedspread was made from original artwork by John Bolton that appeared in the comic-book version of Freak Show. The image was scanned and saved as a PICT file.



5 The final bedspread model, after it had been texture-mapped and rendered in ElectricImage.



4 After exporting the PICT file from Photoshop in ElectricImage graphics format using a plug-in called ElectricImage format (since ElectricImage 1.5 can't directly import PICT files), Ludtke imported it into ElectricImage. In

the texture-mapping dialog box, he made the image into a texture map (selecting Cylindrical Map type and aligning it to the top of the model). He then mapped the finished texture around the bedspread model.



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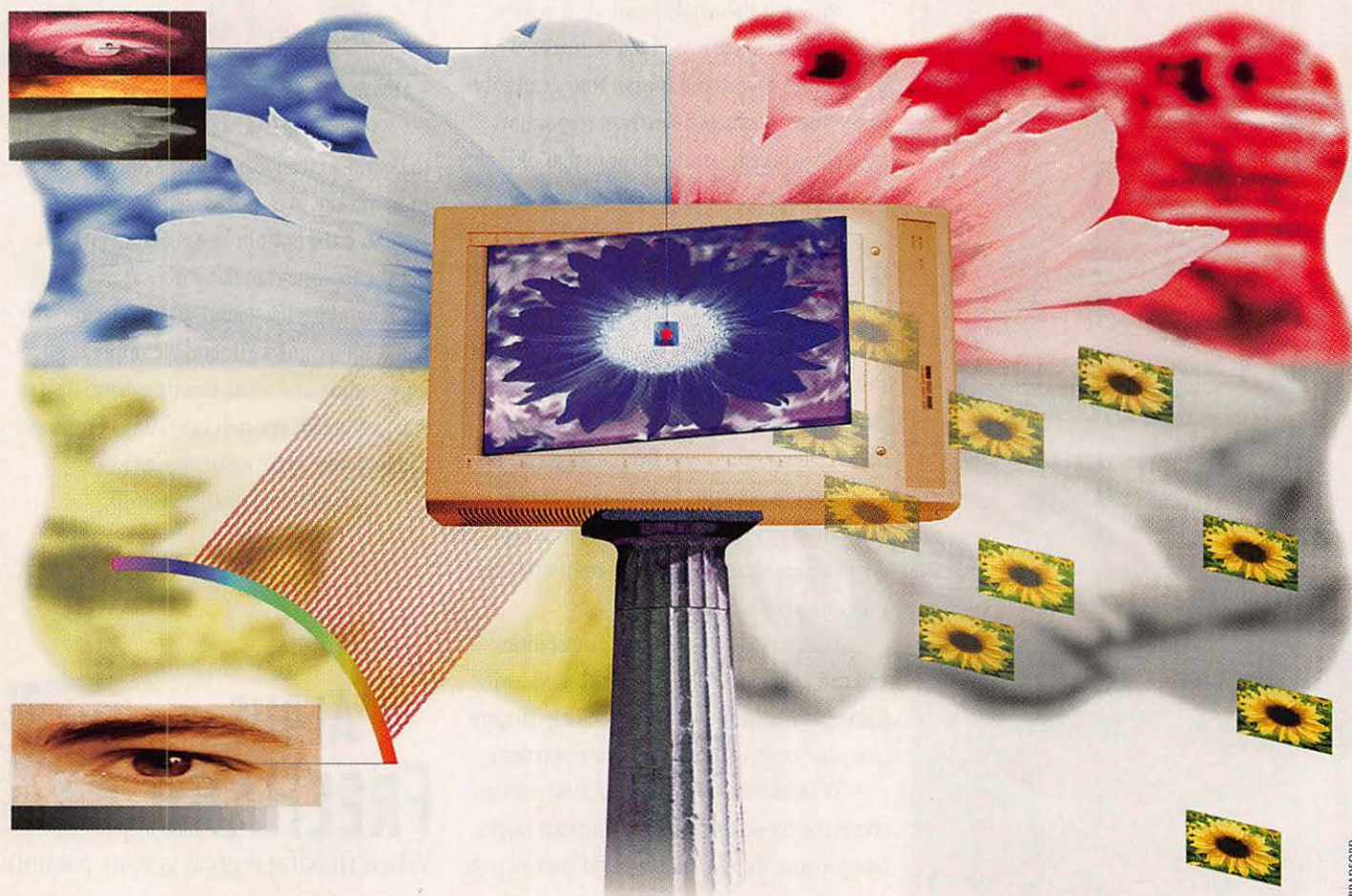


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Make Great Scans

HOW TO PRODUCE HIGH-QUALITY



STUART BRADFORD

In "Halftones Demystified" (*Macworld*, February 1993), I laid out the essentials of working with halftones on the Mac and PostScript output devices. I promised in that article to come back to the subject, concentrating on scanned images—how you can capture the best scans, manipulate them most effectively, and get the best possible output with the least work.

Never let it be said that I don't keep my promises. In this article, I review the four most important imperatives of scanning that will help you produce the highest-quality output from scanned images

gamut from light to dark. If the scanner you're using has poor dynamic range, dark areas all go black—displaying none of the subtle details in the original. And if you try to bring out shadow detail using the tonal-correction methods discussed later in this article, light areas wash out to white or lose the differentiation among samples that defines highlight detail (see "Flatbed versus Drum Scan").

Noise The other quality factor in judging scanners is *noise*—random samples in an area of a given color that don't match their surroundings. It's much like

since these scanners cost anywhere from \$30,000 to \$200,000.

Understanding Resolution

Once you've chosen your scanner, you have to decide on the proper resolution for your images. But before you can do that, you need to understand the difference between *scanning* resolution and *image* resolution.

When you scan a 2-by-2-inch image at, say, 100 spi (your scanning resolution), you end up with a 100-spi image. Place that image on a page, reduce it to 50 per-

OUTPUT FROM YOUR SCANNED IMAGES

with a minimum amount of pain:

- Start with good scans.
- Scan at the right resolution.
- Use tonal correction.
- Use sharpening.

If you adhere to these maxims and follow the rules in this article, you can produce scanned-image output that meets or exceeds the quality of photographically produced halftones—and quite possibly save a chunk of change in the process.

Before we go further, I need to clear up some terminology. I use the word *samples* for the elements that make up a scan, because a scanner *samples* an image every $\frac{1}{100}$ inch, $\frac{1}{300}$ inch, or whatever. I specify image resolution in *samples per inch* (*spi*). I reserve the word *dots* and the measurement *dots per inch* (*dpi*) for the marks that laser printers and imagesetters make, and I use *pixels* for the picture elements that make up screen displays.

Start with Good Scans

Garbage in, garbage out—GIGO. That proverb is doubly true with scanned images. Even if you control the halftoning process to the *n*th degree, your documents will look like poo if you don't have good scans to work with.

Dynamic range To begin with, you need a scanner (or access to one through a service bureau or color house) with good *dynamic range*—the ability to detect subtle differences in color levels across the

static on the radio. Noisy (or dirty) scans can cause quality problems, particularly at lower resolutions.

So which scanner should you use? Among inexpensive 24-bit color flatbeds, recent *Macworld* Lab tests (see "Low-Cost Color Scanners," *Macworld*, November 1993) have favored the Hewlett-Packard ScanJet IIc (just replaced by the ScanJet IIcx; see *Graphics* news, January 1994) and the La Cie Silverscanner II; the Apple Color OneScanner is also a favorite of mine (see *Reviews*, July 1993). These scanners also work well for grayscale and line-art scans, but you won't get the dynamic range you can expect from slide scanners and other high-end solutions. For slides, consider using one of the Nikon, Leaf, or PixelCraft scanners.

If you're scanning a number of 35mm slides or 4-by-5-inch transparencies, check out Eastman Kodak's Photo CD technology, which captures good-quality scans on a CD for around \$2 a scan. Photo CD scans are available from many service bureaus and professional photofinishers; see "Hands-On: Photo CD," *Macworld*, July 1993, for more information.

When top-notch quality is essential, you'll want scans from a drum scanner that uses photomultiplier tubes, such as the Crosfield MagnaScan or Optronics ColorGetter. Unfortunately, you'll pay a service bureau \$25 to \$100 for each scan from these devices, which isn't surprising,

cent, and the image resolution increases to 200 spi—the same number of samples in half the space. That's the basic rule: reduce an image and you increase its resolution; enlarge the image and you reduce resolution. There are a couple of quirks, however: *resampling* and *interpolation*.

Resampling Using a program such as Adobe Photoshop or Fractal Design ColorStudio, you can change the resolution of a scan—adding or removing sample points—without changing its size or dimensions. The process is called *resampling*. It's useful mostly for reducing the resolution of a scan that has more information than you need. In this case the software has a superfluity of data to work with, so it can simply throw some away.

Interpolation If you increase the resolution of an image, on the other hand, the software has to resort to *interpolation* to add samples between existing ones. Interpolation doesn't really add any information, however; it simply adds sample points based on the existing information.

by Steve Roth

Many scanning programs allow you to scan at resolutions that are higher than a scanner's actual optical resolution capabilities by interpolating dots into the scan as it comes in from the scanner. Likewise, you can interpolate samples by increasing the resolution in a program such as Photoshop.

Though interpolation doesn't improve the detail in an image, it can reduce

aliasing (also known as the jaggies). In some situations this lets you output a scan at larger sizes with less image degradation. Interpolation is also useful for increasing the resolution of line art (see the sidebar "600-spi Line Art from 300-spi Scanners").

Scanning at the Right Resolution

The rule of thumb with color and grayscale images is that image resolution should be two times the screen frequency. If you're printing images with an 85-line screen, for example, which is typical of newspaper printing, you only need 170 samples per inch. Higher image resolution does nothing to improve image quality (see "Looking Sharp").

Using lower-resolution scans can save scads of time and disk space. Double the resolution of a scan, and file size increases by a factor of four. Triple the resolution, and the file is nine times as large.

The following table of file sizes for a 4-by-5-inch scan illustrates the difference dramatically.

Image Resolution	8-bit Gray-Scale	24-bit Color
150 spi	439K	1.28MB
225 spi	989K	2.89MB
300 spi	1.72MB	5.15MB

If you're printing on uncoated stock, or under other less-than-optimal printing conditions, you may be able to save even more space and time by scanning at less than two times screen frequency. Try using a multiplier as low as the square root of 2—1.414 times screen frequency (141 spi for a 100-line screen). You may lose some detail with this low-resolution ratio, but the detail may not carry through the printing process in any case.

Resolution for Line Art

The exception to the two-times-screen-frequency rule is black-and-white line art. For a scan of line art to look as good as with photographic reproduction, you need at least an 800-spi image. That's great advice, but what if you only have a 300-spi scanner? The simple solution is to enlarge the original photographically if necessary (even a quality photocopier works), scan the image at 300 spi, then scale it down on the page. For a more devious method, see "600-spi Line Art from 300-spi Scanners."

These high-resolution line-art scans often print slowly on PostScript devices and can crash the print job. Apparently PostScript interpreters are more sensitive to the density of the samples (how closely together they're packed) than to the total file size. (Most imagesetters with Adobe PostScript interpreters have a special bypass routine, however, for black-and-white bitmaps whose resolution exactly matches device resolution. So if you're printing on a 1270-dpi imagesetter, 1270-spi line art can print quickly.) Also, be aware that line-art resolution that exceeds output resolution doesn't do you any good. If you're printing on a 600-dpi printer, 800-spi line art is overkill.

Tonal Correction

Every scan I've ever captured on the desktop was too dark, and most of the desktop scans I see in print have the same problem. Scanned images almost always require *tonal correction*—they have to be made brighter—before they'll print well.

This propensity for dark scans is exacerbated by the tendency toward *dot gain* that I discussed in "Halftones Demystified." To recap, halftone spots in dark areas tend to merge and clog up in the reproduction process (camera work,

PRINTING LIMITS

Printing presses can't print extremely dark or extremely light tints. Tints darker than 90 or 95 percent clog up and go black; tints lighter than 5 or 10 percent just print as white, because the tiny spots of ink don't adhere to the paper.

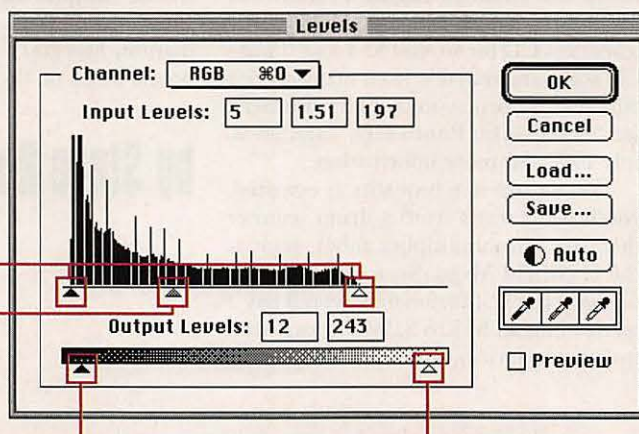
To take best advantage of the information in your scans, compress the useful information into the printable range. The table below shows typical ranges for three classes of printing paper. The third column does the arithmetic for you. These values are just rules of thumb. Talk to your printer (or experiment with your photocopier) to determine the best settings for your printing method.

Printing Stock	Percent Range	Output Levels
Newsprint	12-88	30-225
Uncoated stock	10-90	25-230
Coated stock	5-95	12-243

On the Level

Move these sliders inward to encompass more information in the image. Press the option key while moving the sliders to see which samples in the image are being clipped to black or white.

Move this slider to the left to brighten the image.



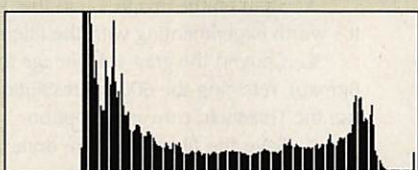
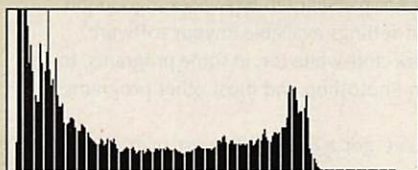
With Adobe Photoshop you can map the useful information in a scan to the full range that your printing method can produce. As shown here, Photoshop will map the values that fall between 5 and 197 (on a scale of 255) out to the 12-243 range. Since the middle input slider is moved to the left, darker values will be spread out more than lighter ones. This technique makes samples in shadow areas *more* different from each other, so image detail becomes more apparent.

Move these sliders in to the values suggested in "Printing Limits."

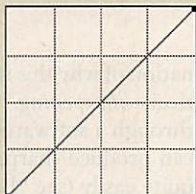
Throwing Curves

These three representations of an image show the obvious advantage of non-linear correction. The graphs reveal how input values (from the scanner) are mapped to output values (what gets printed). The bar charts are histograms; a

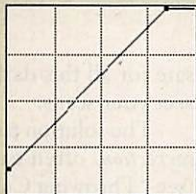
tall bar means there are many sample points in the scan with that value. Dark values are on the left, lighter values on the right. You should apply tonal correction to an image before sharpening.



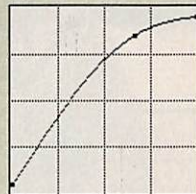
Uncorrected Note how dark the roadway is, and how hard it is to see fine details, such as the bricks in the road (lower-right corner). Light areas have some detail in them (notice the tunnel wall, at right). The histogram shows that all the information is bunched in the dark areas of the image, with little differentiation between adjacent samples.



Corrected by Increasing Brightness The linear correction provided by brightness controls simply increases the value for every sample in the image. There is a barely detectable amount of additional detail in the road, but detail in light areas washes out. All of the information is still grouped in one area; it has just moved up the scale on the histogram.



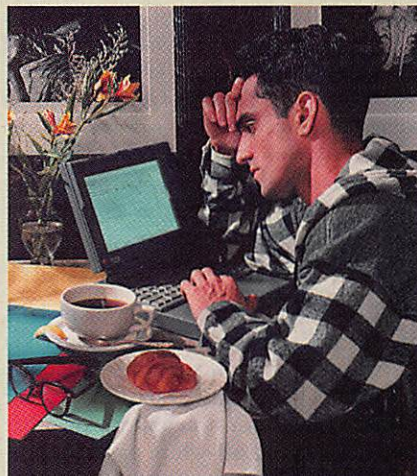
Corrected with Non-linear Correction Detail is more apparent in the roadway, and detail hasn't disappeared from the highlight areas. The values at the dark end of the histogram are spread out rather than simply being moved, so adjacent sample points with slightly different gray values are now more different. This brings out the details in shadow areas.



Looking Sharp

Increasing the resolution of a scan does little to improve its sharpness, as you can see from the three images here. The 300-spi scan (2 times the 150-line screen frequency) is not much sharper than the 212-spi scan (1.4 times the screen fre-

quency) even though the file is twice the size. Neither looks nearly as crisp as the sharpened 212-spi scan.



212 spi (1.07MB)

300 spi (2.12MB)

212 spi, sharpened (1.07MB)



Flatbed versus Drum Scan These two images demonstrate the advantage that a drum scanner's dynamic range provides compared with the more limited capabilities of a flatbed scanner.

The top image, scanned on a Hewlett-Packard ScanJet IIcx, is impressive if viewed by itself. When viewed next to the bottom image (scanned on an Optronics ColorGetter), however, it's apparent how much postscan tonal correction was necessary in the ScanJet image to approach the same quality level.

In order to make the highlights of the sweater as bright and white as they were in the original photo, it was necessary to adjust the shadow areas in the ScanJet image excessively, causing posterization in the shadows, generating some artifacts, and losing color saturation in the foliage.

plate-making, printing), resulting in dark, muddy scanned images. The problem is at its worst with high screen frequencies (where dot gain reigns), especially in poor printing conditions (newsprint or other uncoated stock, off-white paper, reproduction on photocopiers or with paper plates, and so on). You need to compen-

600-SPI LINE ART FROM 300-SPI SCANNERS

It's amazing, but you can capture line art with actual image detail at up to two times the resolution of your scanner—up to 600 spi with a 300-spi scanner, for instance. Light Source's Ofoto 2.0 and ImageXpress's ScanPrep (a plug-in module for Adobe Photoshop) manage this task automatically with a variety of scanners, as does Hewlett-Packard's DeskScan II for the ScanJet series. If you don't have any of those programs, here's how to do it with other tools.

1. Scan the line art at 300 spi in gray-scale mode (or at the highest optical resolution your scanner provides).
2. Resample the image up to 600 spi (or double your scanner's optical resolution). Some scanning software will do this as you scan. Otherwise you can use a program like Adobe Photoshop, Fractal Design's ColorStudio, or even Zedcor's DeskPaint. You can even increase the resolution beyond 2x, up to the device resolution. You won't pick up any more detail, but you can reduce aliasing, giving the art a smoother appearance at the expense of file size.
3. At this point you can use brightness or threshold controls to adjust the width of the lines in your art. This might require some experimentation.
4. Sharpen the image. I find that Photoshop's Sharpen filter does a good job. It's worth experimenting with the filters and settings available in your software.
5. Convert the gray-scale image to black-and-white (or, in some programs, to Bitmap), retaining the 600-spi resolution. In Photoshop and most other programs, use the Threshold conversion option.
6. Save the file and you're done. You've got a 600-spi line-art scan from a 300-spi scanner.

sate for all this darkening when you correct your scans.

The solution to dark scans is *nonlinear correction*, often called *gamma correction* (see "Throwing Curves"). Nonlinear correction allows you to brighten and bring out the details in dark areas of a scan without washing out the light areas to white. It also provides a means to narrow the range of grays in an image, restricting it to values that will reproduce on press (see "Printing Limits"). Nonlinear correction can make dark, seemingly unusable scans look really good.

There are many ways to apply nonlinear correction to a scan. Light Source's Ofoto and Hewlett-Packard's DeskScan II scanning software offer good tools for as-you-scan correction (very convenient, especially if you're scanning and correcting lots of images). Several scanning and image-editing packages provide methods for adjusting the gamma curve.

My favorite method of gamma correction, however, is to use Adobe Photoshop's Levels control, which enables you to take the useful information in the scan and map it out to the full range that your printing method can produce (see "On the Level").

Sharpening

The other problem that's endemic with desktop scans is blurriness. For years, all the desktop scan output I saw—even from the likes of Aldus and Adobe—was blurry. I've never gotten an adequate expla-

nation of why this is so, but there is a solution—*sharpening*. By running scans through a software sharpening filter, you can produce sharp, crisp-looking images quite easily (see "Looking Sharp").

Producing high-quality halftones from the desktop requires judgment. You look at scans on screen, print them on your laser printer, and view their *bistograms* (which show the distribution of tonal values in a scan); check out the values in highlight and shadow areas; look at halftones that you and others have produced; feed in your knowledge of halftoning and printing technology; and toss in a healthy dose of that experience that comes to look and feel like intuition. Then make judgments on what your final output will look like based on all those visual, numeric, graphical, and intangible inputs.

Knowledge, experience, judgment, intuition—hard commodities to come by. But the basic tools for creating high-quality scanned halftones from the desktop—high-quality scanners, tonal correction, sharpening, control over screen settings—are all finally in place. With those tools, the tips and techniques in this article, and a little patience, you can produce halftones of scanned images that rival the best in the business. **m**

Contributing editor STEVE ROTH is coauthor with David Blatner of *Real World Scanning and Halftones: The Definitive Guide to Scanning and Halftones from the Desktop* (Peachpit Press, 1993).

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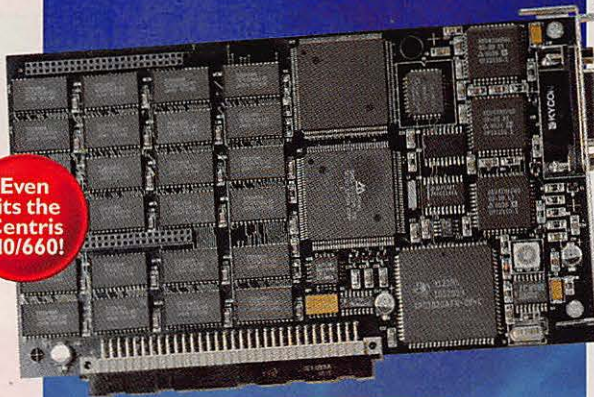
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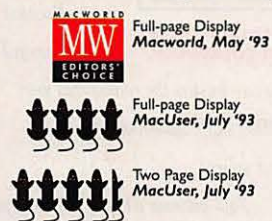
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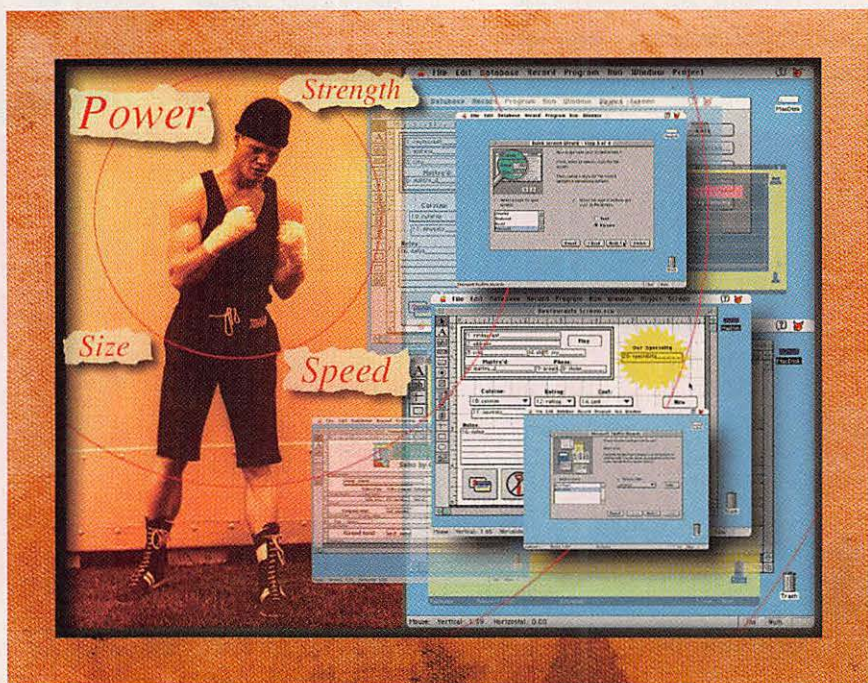
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New Fox on the Block

WHEN THE BIGGEST SOFTWARE company stalks the most important software category, feathers will surely fly: Microsoft is bringing out its long-awaited FoxPro for Macintosh database-development tool, and Microsoft claims it will be just as fast as the contest-winning Windows version. Existing DOS and Windows FoxPro applications will run on FoxPro for Mac; FoxPro translates all platform-specific code and interface objects. For new code, FoxPro provides debug, trace, and compile-error windows, and for FoxBase+ for Macintosh 2.01 applications, FoxPro for Mac will convert screens and reports and will "help" translate procedures. Microsoft says FoxPro will read 4D and FileMaker files but not translate their procedures.

Built-in utilities called wizards will help developers create screens, queries, and reports, and developers can include the report wizard in applications for end users to create their own reports. The query-tool wizard is not available to end users, but the regular query dialog box provides pop-up lists of the fields available to search, displays only appropriate search terms and functions for the data type, and can perform cross-tabulations.

FoxPro for Mac is \$495, and the Distribution Kit run-time engine provides



DAVID KAYE

unlimited, royalty-free distribution for \$495. Both products should be shipping as you read this. The Connectivity Kit, which will ship later for \$295, adds client-server support. Microsoft, 206/882-8080.—D.L.

By importing field and table names from the host, a developer can use DataEdit and DataEdit Designer to build applications with buttons that contain predefined queries or with forms in which DataEdit Client users put together their own queries. Queries are translated into SQL, validated, and sent to the host.

DataEdit 1.1 has record-level locking and an internal scripting language. It supports text fields, a wide range of middleware products, and one-to-one relationships across tables. Version 2.0, which is due to ship in late fall of 1993, adds the ability to run Macintosh DataEdit applications unchanged under DataEdit for Windows. DataEdit and DataEdit Designer are sold as a package for \$999; DataEdit Client is \$199 per client. Brio, 415/961-4110.—D.L.

Data-Dipper Uploads Too

BRIO TECHNOLOGY'S DATAEDIT IS unusual among tools for retrieving data from minicomputer databases: with the proper privileges, a DataEdit application can change records on the host database, add columns or tables to the database, or make other changes.



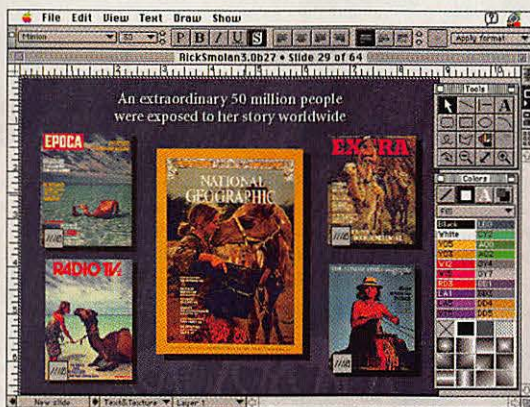
FoxPro's Report Writer is accessible to end users, relieving database developers from the burden of creating every conceivable report.

Persuasion's Portable Presentations

AMONG PERSUASION 3.0'S astounding number of new features is the ability to create presentations that can be distributed freely and played back without Persuasion installed. The new version also adds support for builds, simple animation such as sliding objects on screen, and special effects for transitions between slides.

For designers, version 3.0 provides precise control of elements with ruler guides, a nudge palette, and alignment commands. Its line palette supports user-definable line widths and arrowheads. Improved dithering reduces color conflicts and banding, and handouts can be edited in gray-scale without affecting the screen colors of their corresponding slides.

Persuasion's charting is now an OLE module with 20 chart types and about 90 variations, including true 3-D graphs



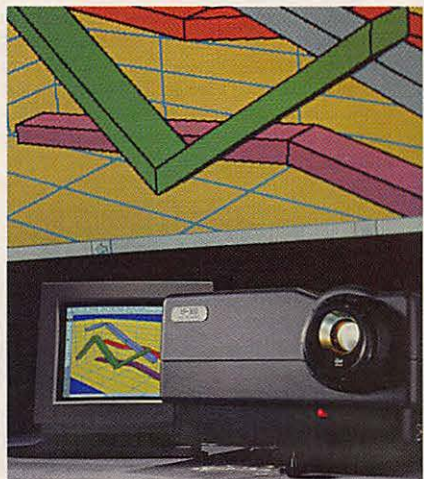
Five objects on a Persuasion 3.0 screen carefully arranged with the Align/Distribute command. Note also the new color and pattern palette.

and pictographs. It can create graduated fills and do curve-fitting, and the table behind the graphs provides a range of statistical and other functions. By the time you read this, Persuasion should be shipping for \$495; upgrades are \$150. Aldus, 206/622-5500.—D.L.

Mutoh Ships LCD Projectors

MUTOH AMERICA IS SHIPPING THREE color projection panels—one with a built-in overhead projector that reduces two pieces of hardware that presenters usually lug around to one piece.

The ViewPoint 100 and ViewPoint 200 sit on a standard overhead projector to shine the Mac's display onto a wall or screen. Besides Mac video, the \$5595



The Mutoh ViewPoint 300 combines a 24-bit color LCD panel with a projector—all you need to add is a Mac.

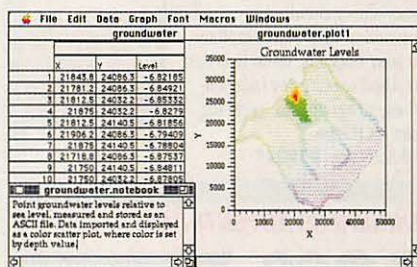
ViewPoint 100 supports EGA, CGA, and VGA. It provides a 185,000-color, active matrix screen and can accept a video adapter to project NTSC or PAL video formats. The \$8995 ViewPoint 200 displays 264,000 colors, can connect to four video sources at one time, and adds support for SECAM, S-Video, and other video formats.

The ViewPoint 300, which costs \$13,495, displays 24-bit color, supports the same video formats as the ViewPoint 200, provides its own light source and lens for projecting the image, and has two speakers built into its case. Mutoh America, 708/952-8880.—D.L.

SpyGlass Focuses on Graphing

SPYGLASS TRANSFORM AND SPYGLASS Dicer turn reams of inscrutable numbers into two-dimensional or three-dimensional displays of colors that reveal hidden relationships in data. Now SpyGlass is providing the missing link in its suite of visualization software: a graphing program, called SpyGlass Plot.

Plot imports the same data formats as Transform: just about anything, including multidimensional data sets and numbers in binary format. Plot provides a rich set



A SpyGlass Plot scatterplot of data on the distribution of groundwater. Depth is indicated using colors.

of functions that can be used to create new columns; can manage 32,000-row-by-32,000-column tables; and has a subset of Tex for formatting all text on a plot. Plot can create line, double-Y, scatter, and parametric plots, as well as a connect-the-dots plot for drawing maps. A macro language can create templates and automate graphing. Plot should ship in early 1994 for \$299. SpyGlass, 217/355-6000.—D.L.

IN BRIEF

FullWrite: Full Steam Ahead

The new owner of the once-ahead-of-its-time but long-abandoned word processor FullWrite is shipping version 1.7 for 68040-based Macs and preparing version 2.0 for January shipment. Version 2 (\$395) will include a view of two editable side-by-side pages and support for external add-ons. It will be controllable with AppleScript, sport a simplified interface, provide character and paragraph style sheets, and support XTND for exchanging files with other word processors. Akimbo Systems, 617/776-5500.

ClarisWorks: Dual Upgrades

While Claris waits until the PowerPC ships to ship a PowerPC version of ClarisWorks (see "Developers Back PowerPC," in News, this issue), the Apple software subsidiary will ship ClarisWorks version 2.1 for 680X0 Macs in February. ClarisWorks 2.1 will support PowerTalk; include filters to import Excel 4.0 spreadsheets with functions and formatting intact, as well as ClarisWorks 1.0 files; and provide hyphenation dictionaries for most European languages. ClarisWorks is \$299, and the 2.0-to-2.1 upgrade will be available free online or for \$12.95 from Claris, 408/727-8227.

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PrecisionColor Pro

PrecisionColor Pro is the fastest 24-bit color graphics card available for the Mac. A bold statement – but true. It's up to 67% faster than its biggest competitor and with the PrecisionColor Pro, you can operate as much as 3,000% faster than your unaccelerated Mac! And PrecisionColor Pro is flexible. You can easily switch resolutions "on-the-fly" or move between one and two-page views with a single keystroke. Fits in all Macintosh NuBus systems and is compatible with a wide range of monitors. Radius #98862



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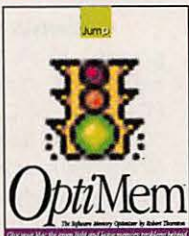


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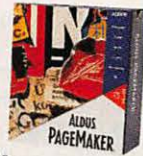


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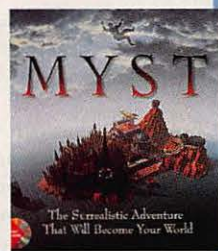


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Working Smart

Graphs That Work

A GOOD GRAPH IS WORTH A THOUSAND numbers—and can illustrate trends and relationships far more effectively. Why is this so? Over the millennia, we've become adept at locating the edges of shapes and discerning size and color differences between them. In other words, skills that helped our ancestors hunt and gather are helping us track the previous quarter's sales results. Now *that's* evolution.

All major spreadsheet and integrated programs have built-in graphing features. You will also find graphing features in some presentation programs, in Adobe Illustrator (version 5.0 \$595; 415/961-4400, 800/833-6687), and even in Microsoft Word (version 5.1 \$495; 206/882-8080, 800/426-9400). And there are myriad stand-alone graphing packages, some with a business slant and others with a more scientific slant (see "Choosing a Graphing Tool").

Graph Basics

Many graphing programs can create quite a variety of graph types: bar, column, line, scatter, radar, pie, and others. How do you match the graph to your data and create graphs that get your message across?

First, choose an appropriate graph type. Are you trying to show how the budget was divided up? Consider a simple pie chart. Do you want to illustrate increasing market share? A column graph is good for showing change over time. Do you need to show the correlation between population growth and freeway congestion? A double-line graph or a column-line combination is good for illustrating comparisons. "A Field Guide to Graphs" shows the most popular graph formats and describes what each is best for.

In any graphing program, you start by specifying the data series—the lists of numbers, or data points, that the graph will represent. A line chart showing a month's worth of closing stock prices contains one data series, while a bar chart comparing a year's worth of quarterly profits for GM, Ford, and Chrysler contains three data series—one for each com-

pany (or four, one for each quarter).

The categories of data—for example, the companies or the quarters you're comparing—are usually plotted along the horizontal, *x*, axis. The data values themselves—the sales figures, for example—are usually plotted on the vertical, *y*, axis. (In bar graphs these two axes are reversed: the categories are stacked vertically, while the bars extend horizontally to indicate values.)

Each data item in a graph—the first quarter's sales figures, the percentage of a tax dollar that goes to space-shuttle toilet design—is a data point (see "Grid and Graph"). In most programs with graphing features, the category names and their

by County." Better versions of these titles might be "1993 Sales Up 10 percent in East" and "Lake County Leads in Home Sales." If you intend your graph to persuade, you could even make the title assertive: "West Needs More Sales Reps."

When titling a graph, determine the graph's primary message. If you can't think of a primary message, you might not need a graph. If the graph has several important messages, maybe you need several graphs, which creates opportunities for titles that tie the graphs together. One graph might be titled "Inventories Grew Last Quarter..." with an adjacent one titled "... While Exports Fell." The ellipses reinforce the relationship between the two graphs.

For a graph with multiple data series, give the bars, wedges, or lines different colors, patterns, or gray shades to set apart the series. Use patterns or gray shades for monochrome output, and colors for slides and electronic presentations. If you use patterns, be sure they differ significantly: at a quick glance, a diagonal line pattern with 8 lines per inch looks a lot like one with 10 lines per inch, but you can't mistake it for one with 16 lines per inch. In any case, gray shades are easier on the eye. Patterns can appear to



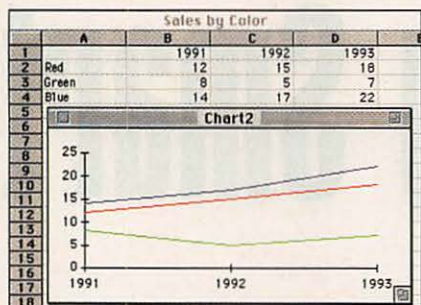
shimmer on the page and distract the eye from the data.

Get the Message Across

Any graph can benefit from a title that not only tells the reader what the graph is about, but also summarizes the graph's key message.

Most people miss that second point and create bland titles like "1993 Sales Summary by Territory" and "Home Sales

For color graphs, choose hues that complement the data: red for a bar graph on a summer heat wave, for example, or green for profitable quarters. Or try coloring one significant element and leaving everything else in monochrome: your company's performance in the color of your company logo, the competition's in black and white. If you use multiple colors, choose sharply contrasting ones—*continues*



Grid and Graph Information displayed in this simple graph is stored in the grid of rows and columns behind it. The categories are color and year; the graphed series is Red, Green, and Blue (1991, 1992, 1993 is another series that could be graphed); and each intersection of a year and a color is a data point.

many people have trouble distinguishing between similar hues.

Any graph with more than one data series is a candidate for a legend that shows what data series the bars, wedges, or columns are derived from. I confess to a bias against legends—having to jump between the graph and the legend weakens the impact and requires more effort. If the graph contains only a few data series, consider labeling bars, wedges, or lines with call-outs instead of using a leg-

end (see "Informative Design"). This approach may not be practical in graphs with many data series.

Most graphing programs allow you to specify where the legend will appear. The location that you choose will affect the

size of the rest of the graph. For instance, putting the legend below a column chart will allow your program to create wider columns, but the chart's vertical axis will be compressed. Experiment to find the lo-
continues

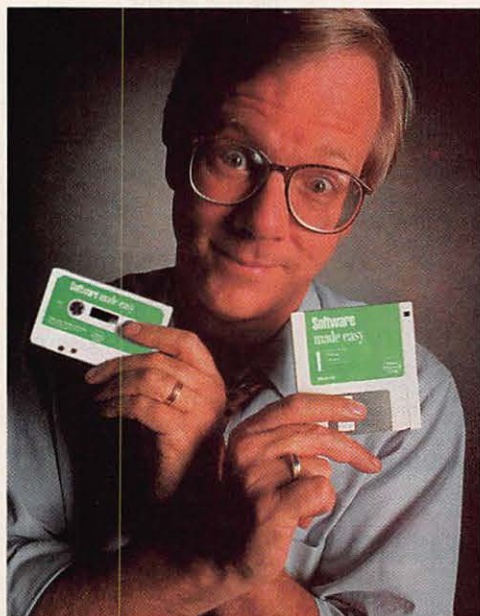
CHOOSING A GRAPHING TOOL

Today's spreadsheet programs—particularly Microsoft Excel (\$495; 206/882-8080, 800/426-9400)—have excellent built-in graphing features. Still, if you create graphs often or you need specialized graphs, consider a stand-alone graphing program such as Computer Associates' CA-Cricket Graph III (\$129; 516/342-6000, 800/225-5224) or DeltaPoint's Macintosh DeltaGraph Pro 3.0 (\$195; 408/648-4000, 800/446-6955).

What does a stand-alone graphing program bring to the table? A wider selection of graph formats, for one thing. Excel provides 14 graph types with about 90 variations, while DeltaGraph, for example, provides 57 types with about 200

variations. More important, DeltaGraph provides some exotic graph types that you won't find in a spreadsheet—for example, bubble graphs, with data-point symbols that vary based on the values they represent—and DeltaGraph provides more control over formatting. If you create a particular type of graph often, you can create templates or macros for formatting chores.

For scientists and researchers, there are several dedicated scientific graphing packages, including WaveMetrics' Igor (\$295; 503/620-3001), Synergy Software's KaleidaGraph (\$249; 215/779-0522, 800/876-8376), and Jandel Scientific's SigmaPlot for the Macintosh (\$295; 415/453-6700, 800/874-1888).



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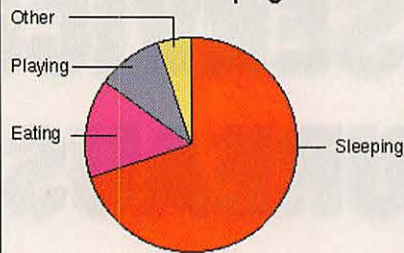


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How Dogs Spend Their Time



Dogs Spend Most of Their Time Sleeping



Informative Design The pie chart on the bottom reflects two principles of effective graph design that are lacking in the top pie chart. The bottom pie chart's title summarizes the chart's message instead of merely summarizing its topic, and it employs call-outs that allow you to dispense with the legend.

cation that will least intrude on the graph's message.

Add Precision and Legibility

A graph's first job may be to communicate trends or data at a glance, but there's no reason a graph can't also convey hard facts. By displaying the numbers being represented, you provide more detail for readers who give the graph a closer look. This works especially well for bar, pie, and column graphs.

If a graph contains many data series, you might need to use a space-efficient font so that the values will fit between the columns or bars, or on top of the pie wedges. Helvetica Condensed or Helvetica Narrow are good fonts for this. But you should keep in mind that if your graph shows too much data or is too small, it might be necessary to forget about displaying data values.

Speaking of graph typography, avoid using all capital letters for value or category names or graph titles. If this text is coming from spreadsheet cells, plan ahead when you create the original spreadsheet. For chart titles, consider the final medium: if you're creating slides or overheads, stick with sturdy, sans-serif faces such as Helvetica Bold or ITC Franklin

Gothic Bold. (See last month's *Working Smart* for more advice on choosing typefaces for presentations.)

You can enhance legibility in bar, column, and line charts by adding grid lines—horizontal or vertical lines that run at right angles to the value axis and guide the eye from data points to the closest value on the value axis. Only add grid lines if they genuinely help readers interpret the data, and make them a light gray or other unobtrusive color that won't draw attention away from other graph elements.

Problem Data

For all your efforts to improve legibility, sometimes your data works against you. For example, if two or more pie-graph wedges are similar in size, it's difficult to discern the differences between them. One solution to this problem might be to drag the wedge you want to accentuate a short distance away from the rest of the pie. Another solution might be to use a bar or column graph—the eye can discern differences in lengths more easily than differences in area.

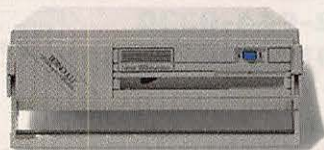
If you have one data series with values dramatically larger than the others', you

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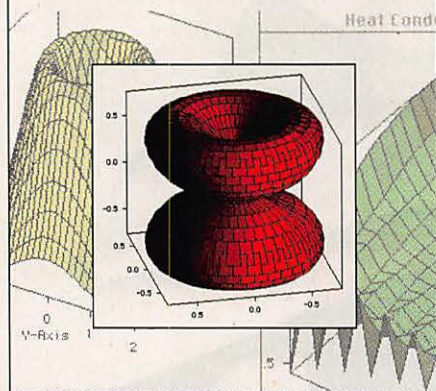
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might want to change the scale of the graph's value axis to accommodate the other values and then extend the oddball bar beyond the graph's boundaries. You need a draw program to perform this kind of modification, but since graphs are actually object-oriented graphics, it is no problem to copy and paste a graph into your draw program, where you can ungroup and modify its elements.

Designer Graphs

These days it's fashionable to decorate graphs with cartoons, icons, symbols, and other gimcracks. *USA Today* is often guilty of garish graphing, and many newspapers and magazines are jumping on the bandwagon. Some programs provide features that make creating these kinds of graphs easier. Adobe Illustrator 5.0, for example, lets you specify a symbol or shape to replace a plain bar, column, or other data-point marker.

Many graphing gurus despise this kind of decoration. To me, a little bit of decoration—pencils instead of bars in a graph about scholastic test results, for example—isn't a cardinal sin. But using a three-dimensional graph to represent two-dimensional data is a serious offense. Most graphing programs let you create 3-D bar, column, and line charts where each column looks like a little obelisk or each line looks like a ribbon. Not only does this kind of graph make it hard to decipher the original data, but its 3-D perspective can distort or de-emphasize some of the data. Don't enter the third dimension unless your data really is three-dimensional—for example, if you want to show several quarters' sales results for GM, Ford, and Chrysler products in several regions, then you have a real 3-D data set that requires a 3-D graph. Even so, you run the risk of distorting or obscuring some data.

For more background on designing graphs, read *The Visual Display of Quantitative Information*, by Edward R. Tufte (1983; \$40 from Graphics Press, 203/272-9187, 800/822-2454). This beautiful book is the definitive guide to creating data graphics. One of Tufte's principles should be emblazoned on the wall in any office where graphing programs are used: "Graphical excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space." **m**

Next Month: Managing Mailings

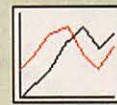
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A FIELD GUIDE TO GRAPHS

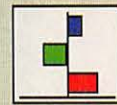
Area Compares changing values for several items over time. Area graphs emphasize the relative value of each series.



Double Line Compares changing values for several items over time. Like area graph, but emphasizes time instead of values.



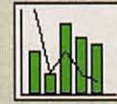
Bar Compares values for several items at one time (or shows values distributed over a period of time).



Column Identical to a bar chart, but positions the categories horizontally and the values vertically.



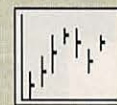
Combination Overlays two chart types to compare two data series—for example, actual sales versus projected sales.



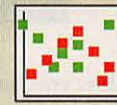
Pie Shows the relationship of parts to a whole. Can display only one data series.



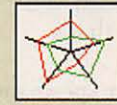
High/low/close Shows highest, lowest, and closing values for multiple items. Commonly used for displaying stock quotes.



Scatter Shows the relationship between several data series. Useful for finding dependencies between series.

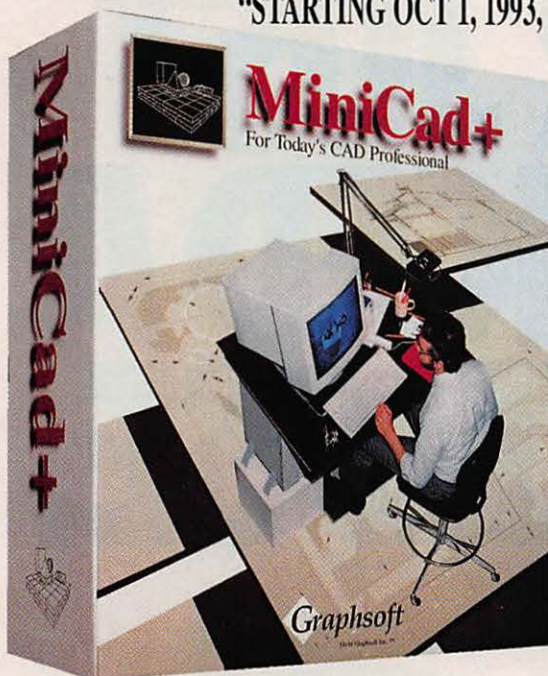


Radar A line radiating from the center represents each category; values are shown by distance from the center. Useful for comparing several items on multiple criteria.



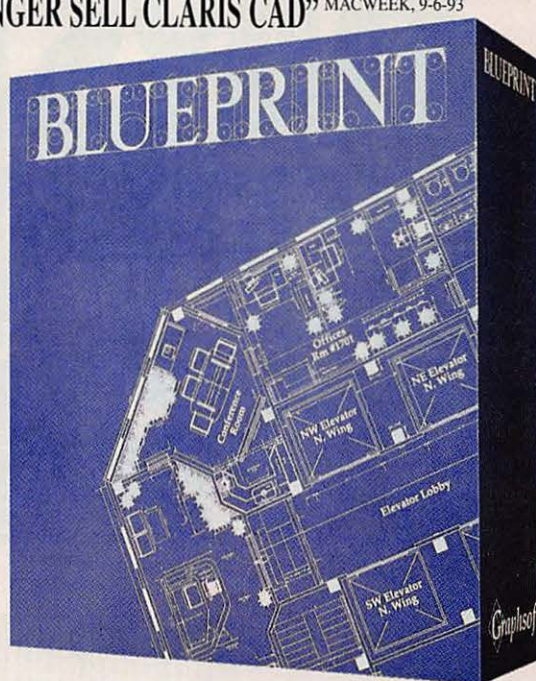
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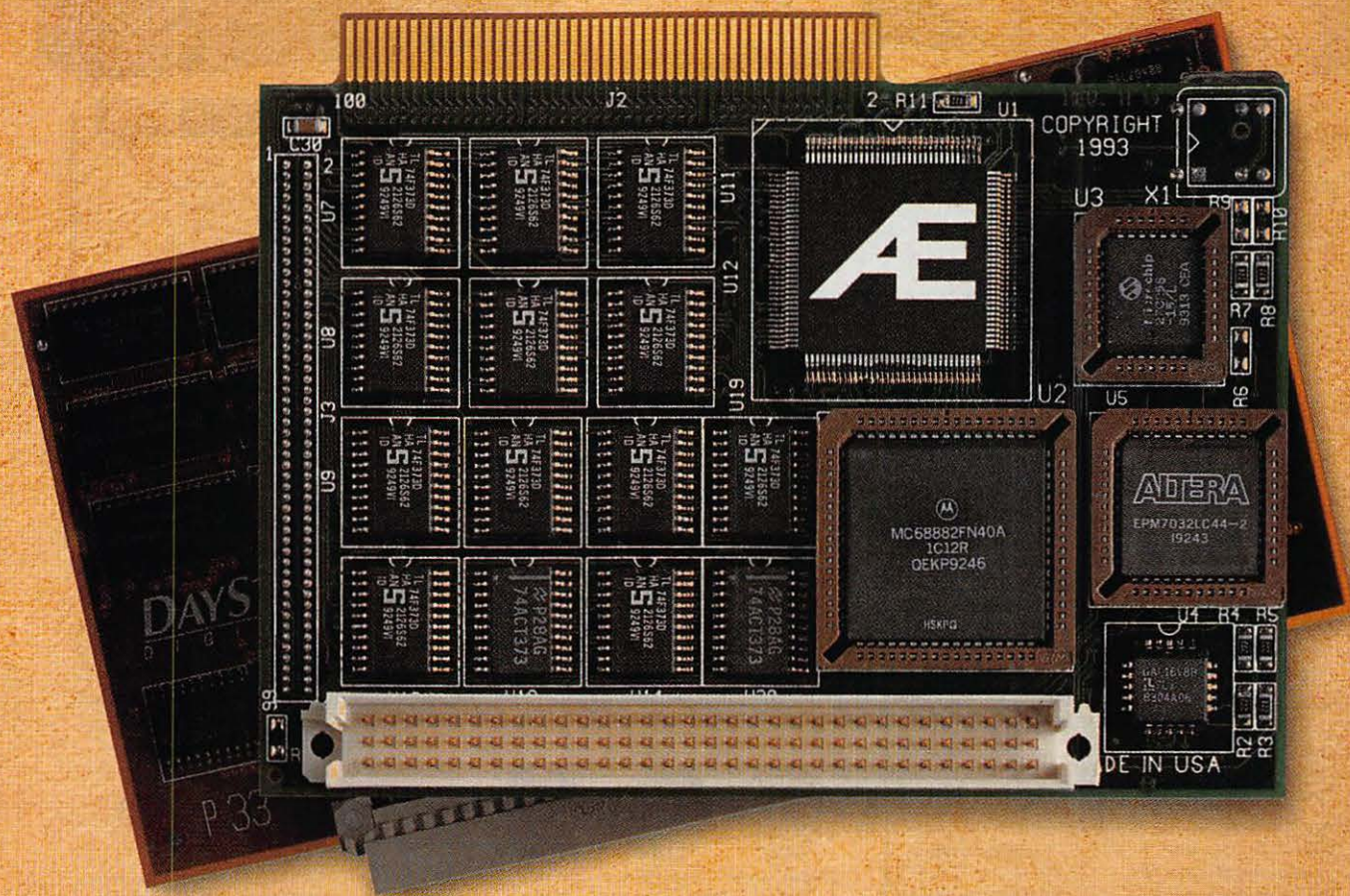
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	40 MHz	AE	6.2	Yes	\$349
		DAYSTAR	NA	No	NA
68030 LC, LCII Color Classic Performa 400 Series	40 MHz w/Cache	AE	11.5	Yes	\$428
		DAYSTAR	11.09	No	\$698
	33 MHz	AE	2.65	Yes	\$449
		DAYSTAR	2.52	No	\$498
68040 II, IIx, IIci, IIvi, IIvx, IIsi Performa 600 Series	40 MHz	AE	3.13	Yes	\$449
		DAYSTAR	3.07	No	\$698
	25 MHz	AE	4.5	NA	\$999
		DAYSTAR	4.7	NA	\$1,299
	33 MHz	AE	5.0	NA	\$1,199
		DAYSTAR	5.0	NA	\$1,599
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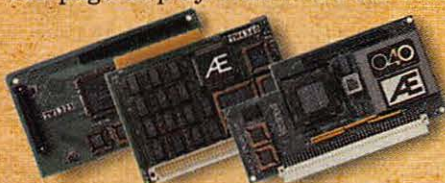
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Circle 168 on reader service card

INTEGRATED

by Joseph Schorr

Write it, figure it, chart it, and draw it—four all-in-one packages that do it all

Integrated “works” programs are the high-tech equivalent of those all-in-one kitchen appliances that dice, slice, chop, peel, and create the ultimate radish rosettes. Works programs serve up a smorgasbord of basic business applications that most users need—word processor, database, spreadsheet, draw, paint, and communications programs—in one compact, low-cost package.

To be sure, the individual components lack the power and polish of their stand-alone counterparts; don’t expect a works program to handle style sheets with the grace of Microsoft Word or to create the dazzling 3-D graphs Excel gives you. Nevertheless, the best of these all-in-ones pack surprising power—plenty for most average users—at a very attractive price. Do the math: to buy separate word processing, database, spreadsheet, drawing, painting, and telecommunications software can easily cost over \$1000. By contrast, the most expensive of the integrated works programs discussed here lists for \$299 and has a street price under \$200.

These programs especially appeal to users who don’t need high-level features, but they’re not just for beginners. A program like ClarisWorks, for example, can be a great value for PowerBook users; it takes up only 601K on disk, needs as little as 800K to run, yet provides the essential tools to write a report, work up a slide presentation, edit a spreadsheet, or connect to a remote computer.

These programs vary considerably in quality, however, and some, frankly, are bad investments. *Macworld* evaluated four works programs available for the Mac: Claris Corporation’s ClarisWorks, Symantec Corporation’s GreatWorks, Microsoft’s Microsoft Works, and WordPerfect Corporation’s WordPerfect Works (an upgrade of the now-defunct BeagleWorks, purchased from Beagle Bros Software). One critical measure of a works program, apart from the quality of the individual modules, is how well the modules talk to each other. How easy or

difficult is it to take the data you’ve compiled in your spreadsheet and drop it into your multicolumn word processor document? How much trouble is it to place linked columns of text into a draw document to do basic page layouts?

Integration

Of the four, ClarisWorks provides the fastest and most seamless integration. You can drop a spreadsheet right into a word processing document—no importing, exporting, publishing and subscribing, or even cutting and pasting. Just drag a rectangle where you want the spreadsheet to appear—and start crunching the numbers. Tools and menus change instantly to accommodate whatever type of object you’re working on. Double-click on a bitmapped graphic within a word processor document, and paint tools pop up so you can edit the picture—no waiting while the program opens the selected item in a separate window.

By contrast, GreatWorks has strong component modules, but they’re clumsily integrated. To bring a spreadsheet into a word processing document, you have to paste it in as a picture; to maintain a live link with the original spreadsheet, you must activate publish and subscribe. To edit the spreadsheet, you have to fetch the original document using standard publish-and-subscribe commands. In other words, two GreatWorks modules are no more tightly integrated than any two stand-alone Mac programs. Microsoft Works is even worse; it doesn’t even support publish and subscribe.

WordPerfect Works’ integration scheme, based on System 7’s publish and subscribe capabilities, is functional but not elegant. You can mix spreadsheets, drawings, paintings, and text on a page, but each must be edited in its own window-within-a-window. When you double-click on a spreadsheet embedded in a text document, for example, you must wait as the spreadsheet opens in a miniwindow and the proper tool environment appears.

Here's how these four contenders rate module by module.

Word Processing

A strong word processor is essential to any works program. The integrated programs we looked at handle the word processing basics, but all four leave out a handful of important features. ClarisWorks, for example, has no word-count feature (which as a journalist I miss), while Microsoft Works doesn't handle multiple columns. Here's how they stack up.

ClarisWorks ClarisWorks offers an impressively powerful word processing module. It's the only one that lets you insert a text file, a graphic, or even a QuickTime movie without copying and pasting. It also offers a superb outline view (with six formats), custom column widths, character-level styles (so you can apply a font, size, and style with one command), footnoting, and the ability to wrap

text around irregular graphics. Yet ClarisWorks lacks some capabilities you might expect to see even in a stripped-down word processor, such as tables and word count, and paragraph-level styles. Still, it's the most efficient word processor in any of these works programs.

GreatWorks GreatWorks, too, lacks paragraph styles, but it lets you define character styles, which it automatically assigns $\text{\$}$ -key shortcuts. The adequate outliner resides in a separate module. Page-design tools are GreatWorks' Achilles' heel. You can't wrap text around irregular objects, or zoom in to see details or out to view a whole page. To preview a page, you have to click on a Preview button tucked away in the Print dialog box. And the omission of footnoting makes GreatWorks unsuitable for writing research papers.

GreatWorks does have a few neat filiphs. It's the only works program with an

envelope-printing feature and the only one that can automatically place a hairline rule between columns of text.

Microsoft Works This skimpy word processor bears but faint resemblance to its respected cousin, Microsoft Word. You get neither paragraph styles nor character styles, and no multiple-column options. Also, it can't display invisible characters such as paragraph marks and tab indents—a real hindrance to anyone who does serious word processing.

Two redeeming points are Microsoft Works' footnotes and its macro function, which lets you record keystrokes—a return address, say—and have Works type them for you. There's also a convenient floating palette with pop-up menus for choosing, sizing, and styling fonts. But these hardly make up for the module's omissions or its sluggishness.

WordPerfect Works First the good news: this is the only word processing module that supports full-fledged paragraph styles, as most stand-alone word processors do. You can even import style sheets from one document to another for consistent formatting.

Sadly, there's little else to recommend this word processor. It doesn't handle footnotes, which rules it out for researchers. And while you can type or paste text into frames for page layouts, you can't link frames to flow text to the next designated frame as in both ClarisWorks and Microsoft Works. Also, when you set text in multiple columns, WordPerfect Works doesn't let you customize the width of each column, as other programs do.

Draw

Once again, all four programs give you the bare-bones basics you need to create maps, diagrams, and fancy titles; but only a couple have the power for more refined graphics work requiring precisely rotated images or making illustrations with layers.

ClarisWorks ClarisWorks' intuitive drawing environment will seem familiar if you've worked with MacDraw Pro or ClarisDraw. The interface offers impressive custom gradients and excellent shape tools, including the bezigon tool, for shaping freehand objects. Despite a few limitations—you can rotate objects only in 90-degree increments, for instance—this module is a treat to use. The ability to zoom from 3200 percent down to 3.13 percent makes it easy to refine tiny details and get an overview of large drawings. And the tools are almost always available, so whatever module you're in, you can draw directly in text documents, spreadsheets, charts, or databases.

GreatWorks This draw module is almost on a par with ClarisWorks'. The

Comparison of Works Packages

	ClarisWorks 2.0v1	GreatWorks 2.0.1	Microsoft Works 3.0	WordPerfect Works 1.2.1
General				
Company	Claris	Symantec	Microsoft	WordPerfect
Price	\$299	\$129.95	\$249	\$249
Phone	408/727-8227	408/253-9600	206/635-7160	801/228-9901
Toll-free phone	800/325-2747	800/441-7234	800/426-9400	○
Word Processor				
Paragraph/character styles	○/●	○/●	○/○	●/●
Zooming options	3.13%–3200%	○	○	25%–800%
Footnotes	●	○	●	○
Directly insert file	●	○	○	○
Mail merge with database file	●	●	●	●
Outlining	●	●	○	○
Envelope printing	○	●	○ ^a	○
Maximum columns	9	10	1 ^a	16
Custom column widths	●	●	NA ^a	○
Macros	●	○	●	○
Show invisibles	●	○	○	●
Compatible file formats	32	30	19	35
Draw				
Maximum drawing size	^c	48" × 50"	8.5" × 11"	56" × 56"
Gradients	●	●	○	○
Custom gradients	●	●	NA	NA
Free rotate	○	○	● ^d	○
Zooming options	3.13%–3200%	25%–800%	○	25%–800%
Line weights (in points)	.02–255	hairline–64	1–10	1–8
Edit patterns/colors	●/●	●/●	○/○	●/○ ^e
Smoothing	●	●	●	●
Align/distribute objects	●/●	●/○	○/○	●/●
Eyedropper	●	●	○	●
Edit arrows	○	●	○	●
Multigon tool	●	●	○	○
Bind text to curve	○	○	●	○

● = yes; ○ = no/none; NA = not applicable. ^a Preformatted envelope printing available in database. ^b Text can be placed in multiple columns when in draw mode. ^c Limited only by available memory. ^d Must specify angle in a dialog box.

^e Colors can be edited in paint mode.

Comparison of Works Packages (continued)

	ClarisWorks 2.0v1	GreatWorks 2.0.1	Microsoft Works 3.0	WordPerfect Works 1.2.1
Paint				
Gradients	●	●	NA	○
Edit spray can/brushes	●/●	●/●	NA	○/●
Stretch and resize	●	●	NA	○
Skew and shear	●	●	NA	○
Distort	●	●	NA	○
Perspective	●	●	NA	○
Free rotate	●	●	NA	○
Lighten and darken	●	●	NA	○
Control bit depth	●	●	NA	● ^f
Resolution (in dpi)	72-360	72	NA	72
Brush mirrors	○	●	NA	○
Magic-wand tool	●	●	NA	○
Transparency controls	●	○	NA	○
Database				
Text fields with scroll bars	○	●	○	○
Create list of values for a field	●	○	○	○
Automatic serial-number entry	●	●	○	○
Number of Avery label formats	73	○ ^g	29	○ ^g
View as list option	●	●	●	●
Maximum layouts	255	255	33 ^h	1
Add graphics directly to layouts	●	●	●	○
Built-in functions	91	94	57	54
Macros	●	○	●	○
Sliding fields	●	●	●	○
Picture fields	○	●	○	●
Time and date field	●	●	●	●
Spreadsheet/Chart				
Maximum cells (across/down)	256/16,384	256/16,834	256/16,832	256/16,834
Built-in functions	100	103	64	57
Hide cell grid	●	●	●	●
Append notes to cells	○	○	●	●
Headers and footers	●	●	●	●
Hide row and column headers	●	●	1	●
Adjust row height/column width	●/●	●/●	○/●	●/●
Draw directly on spreadsheet	●	●	● ^k	○
Number of chart types	12	8	6	8
Create chart from within spreadsheet	●	○	●	●
Charts support gradients	●	●	○	○
Date formats/time formats	5/4	9/6	10/4	5/4
3-D charts	●	○	○	○
Pictogram charts	●	●	○	○

● = yes; ○ = no/none; NA = not applicable. ^f Choices are limited to full color or black-and-white. ^g Can create custom labels using generic templates. ^h 16 form layouts, 16 columnar report layouts, and 1 list-view layout. ⁱ Limited only by available memory. ^j Headers can be suppressed when printing. ^k Involves switching mode to access draw tools.

of search criteria as a filter and apply the filter with a macro, for example. This still doesn't make up for an ungainly interface.

WordPerfect Works Like Microsoft Works' module, this database employs a spreadsheetlike approach—you type data in an entry bar, not in the actual fields. But what's really miserable is that you can't add graphic elements directly to a layout; no drawing tools are available. To add just one rule or title, you must create a new draw document, name and save it in a dialog box, and then position its frame

on the database layout. It's an unbearably roundabout process. To make matters worse, the commands used to apply borders and shading to fields yielded inconsistent results. On top of all this, the module offers only 54 built-in functions and seems remarkably unintuitive to use.

Spreadsheet/Charting

All the spreadsheet modules build in the formulas most users need to assemble decent spreadsheets of up to 256 columns and well over 16,000 rows. Formatting

options aren't wildly impressive, and while all the programs generate functional charts and graphs, the variety won't bowl you over.

ClarisWorks ClarisWorks' spreadsheet is the best, with 100 built-in functions. You get extensive control over how a document displays—with or without column and row headers or gridlines. To make a chart, you simply select a range of cells and choose the Make Chart command. You can pick from 12 chart types—and it's the best selection; some can be shadowed or shown in 3-D. A tilt option positions pie charts at an angle, mimicking perspective.

Once you've created a chart, it's easy to dress it up, changing colors, fonts, and patterns or applying gradients. ClarisWorks also allows you to paste in PICT graphics to create pictogram charts.

GreatWorks GreatWorks' spreadsheet shares many of ClarisWorks' strengths. In fact, it has three more built-in functions and a better variety of time and date formats. The main drawback is that GreatWorks handles charts and spreadsheets in separate modules. After selecting a range of cells, you have to open a new Chart document to create the chart. Then you must paste the chart or publish it to place it in a finished document—a cumbersome procedure.

As with ClarisWorks, you can easily change a chart's colors, patterns, and fonts, and you can paste in your own graphics to create a pictogram chart. None of its eight chart types are quite as fancy as those generated by ClarisWorks.

Microsoft Works This is a Stone-Age spreadsheet. It's limited to 64 built-in functions, lacks many significant features, and has only 6 chart types. You can't change the height of rows or hide row and column headers on screen. As in all of Microsoft Works' modules, you can't zoom out to view a large spreadsheet or home in on details. And character formatting is utterly bizarre: if you try to change the font or font size in a single cell, the entire spreadsheet changes to the new format, not just the selected cells. That means one font in one size per spreadsheet. Yet changing color and type style affects selected cells only.

To be fair, this module has two good features. One is borrowed from Excel: you can record notes on individual cells. A tiny black rectangle appears in any annotated cell. Also, when you use the Paste Function command, Microsoft Works provides a brief, helpful explanation of each function as you select it.

WordPerfect Works Here again are some very sensible features along with some very bad ones. Buttons on the well-

designed tool bar let you quickly apply the most common cell formats—borders, shading, boldface, italics, and numerical formats such as currency or percentages. Another button lets you Sum a selected row or column of numbers with one click. Formatting options abound. For example, you can display negative numbers with a minus sign, in red, in parentheses, or with a combination of these. Borders and gridlines can be in any of eight colors, instead of black only, as in the other programs. Like Microsoft Works, the program can append text notes to cells.

The bad news is that you can't access the program's drawing tools when working in the spreadsheet, to circle a cell, for example, or draw an arrow pointing to a significant figure. Also, the program's charting scheme is particularly weak. The eight chart types are uninspiring and exist apart from the spreadsheet; when you click on the chart-making button, WordPerfect Works opens a draw window and builds the chart there. This is slow and the results are unimpressive.

Communications

Since most modems come bundled with full-featured telecom software, and online services such as CompuServe and America Online provide their own specially tailored telecom packages, a works program's communications module is probably its least-used part. So when you're choosing among works programs, telecom capabilities needn't be a major consideration—that's why we don't list these features in the product-comparison table.

Good thing, too, because none of these programs is particularly strong in this area. They all rely on the Apple Modem Toolbox and provide little beyond the essentials. All four can make either a modem connection or a serial connection (to connect your Mac directly to another computer). And all at the very least allow you to use TTY and VT102 terminal emulations and to send and receive files using Xmodem and other protocols for transferring text files.

ClarisWorks The ClarisWorks telecom module includes a simple phone-book feature for storing frequently used numbers. Clicking on the phone-dial icon on the status bar displays a pop-up menu of all numbers; selecting one dials that number and opens the connection. However, ClarisWorks doesn't save line settings (baud rate, stop bits, parity, and so on) along with the phone numbers, so you need to check those manually before each call—an unnecessary hassle.

Along with the standard Xmodem and text-transfer tools, the module comes with Kermit, a file-transfer protocol, use-

ful for exchanging files with computers that can't use Xmodem. Best of all, you can use ClarisWorks' macros to handle dialing and logging on. You can instruct the program to wait for a specified text string such as "Connect" before automatically typing a log-on sequence.

GreatWorks This is a very minimal module. It comes with tools for Xmodem and text file transfers only. A status bar tells you at a glance the terminal emulation, the file-transfer protocol, and whether a serial or modem connection is selected. But there's no way to store phone numbers, so you have to enter them manually every time you make a connection.

Microsoft Works This module includes some attractive features. A small palette gives easy access to the tools you need to select a folder for capture files and to open a connection. In addition to providing Xmodem, text transfer, and Kermit tools, only Microsoft Works supports VT320 terminal emulation. It's also the only one that can automatically calculate the cost of an online session based on the service's per-hour or per-minute rate. A macro feature lets you record a sign-on sequence for automatic playback. With all that done right, the omission of a phone book seems an odd oversight.

WordPerfect Works This is the standout communications module. The status bar displays the current settings, time, and date, while buttons on the tool bar give quick access to all the most frequently used commands. And finally—a phone book that stores numbers along with their connection settings. You can teach the program to dial one number at 9600 bps using the TTY emulation and another at 2400 bps with the VT102 emulation—saving you the trouble of adjusting the settings. A miniscripting feature lets you automate connections. You can instruct the modem to wait for a specified text string, pause for a designated number of seconds, then enter a password.

The Works that Works

The clear winner in this roundup is the polished and elegant ClarisWorks. Its modules are tightly integrated and each offers solid performance. By the way, ClarisWorks is also the only one of the four with a slide-show feature. In a pinch, you can create and display a business presentation without leaving ClarisWorks—and get fairly impressive results.

On top of all that, ClarisWorks is the most compact of the programs—perfect for PowerBook users pressed for disk space and memory (whereas Microsoft Works, the weakest program, is the largest, taking up 1.1MB and suggesting a

1MB memory partition). True, ClarisWorks is the most expensive, but for only \$50 more (list price) than Microsoft Works or WordPerfect Works, you get a much better product.

GreatWorks and WordPerfect Works rank about evenly behind ClarisWorks. WordPerfect Works has the better telecom and word processing features but falls well short of GreatWorks in the drawing, painting, and spreadsheet/database departments. Bargain hunters may be drawn to GreatWorks' low price—for only \$129.95 list you do get a lot. But remember that its modules are poorly integrated, and Symantec has no upgrade plans on the near horizon.

At the bottom of the heap, underpowered and out of date, is Microsoft Works. Incredibly, for nearly twice the price of GreatWorks it offers about half the features. Microsoft plans a great leap forward when Works 4.0 ships early in 1994. In addition to greatly enhancing the program's current powers—and adding a paint module—Microsoft promises to provide elegant integration, even building in an address book, calendar, and scheduler. There will be scripts that automate certain tasks, and templates for creating forms, phone directories, business cards, and other documents.

If Microsoft delivers, Works could become a most appealing option. Until then, steer clear—and then check to see how it rates against the ClarisWorks upgrade, also planned for early 1994. For now, ClarisWorks is clearly the all-in-one choice. **m**

JOSEPH SCHORR is a Mac trainer, troubleshooter for a publishing company, and coauthor of *Macworld Macintosh Secrets* (IDG Books Worldwide, 1993).

INTEGRATED SOFTWARE

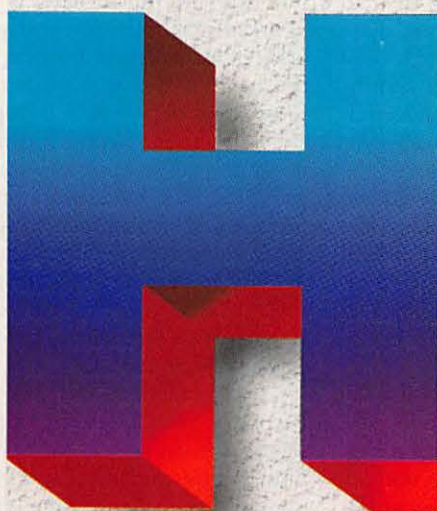


It was easy to pick a winner in this roundup. While none of the integrated works programs has it all, at least one offers an impressive selection of practical features, a polished interface, and an excellent integration between modules.

ClarisWorks ClarisWorks offers the most seamless integration between modules and the best overall collection of features in an integrated works program. It's also the most compact. **Company:** Claris Corporation. **List price:** \$299.

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Software Development Update



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217 Sherman Avenue
Cleveland, OH

Via Hand Delivery
Thursday, June 24, 1993

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Circle 85 on reader service card

Quick Tips

Tips, Tricks, and Shortcuts

SEVERAL TYPOGRAPHICAL ERRORS CREEPT into last December's tip "Extracting Names." A minus sign was left out of the LenLN formula. It should read: `LenLN = (Length(Name)-Posx+1)-IsJR*(Length(JR)+1+if(Middle(Name,PosX0-1,1)=",",1,0))`. Also omit the two extraneous characters <* at the beginning of the Name and LastName formulas, and omit the two extraneous characters *> at the end of the LenLN and Error formulas.

Printer Driver Upgrade

StyleWriter owners no longer have to hunt and beg for StyleWriter II driver software (as suggested in December's *Quick Tips*) to print shades of gray and share their printers over a network. Apple has approved version 1.2 of the StyleWriter II driver for StyleWriter and StyleWriter II printers, and has approved version 1.2 of the LaserWriter 300 driver for Personal LaserWriter LS printers. These drivers are part of Apple's recently released software upgrade kit euphonically titled StyleWriter and Personal LaserWriter LS Printer Driver Upgrade. The kit also includes the eight basic TrueType font families and is available for \$49 from *The Apple Catalog* (800/795-1000, Cat. No. E2259). These drivers are also now available on AppleLink (in the Software Sampler folder).

The StyleWriter II 1.2 driver also speeds up printing—in my informal testing on a Mac IIx, 50 percent for simple text and 2700 percent for multiple fonts and styles. Gray-scale printing looks fabulous but takes longer and uses immense amounts of disk space for temporary files on the start-up disk. For example, printing a half-page FreeHand document (Aldus's sample Medical Illustration) took 19 minutes (35 minutes printing in the background) and 11.5MB. You'll find performance varies, depending on the speed of your Mac, the complexity of your documents, and what else you're doing

with your Mac at the same time.

If you happen to be using a version of the StyleWriter II driver lower than 1.2 with an original StyleWriter printer, *do not* click the Options button in the Print dialog box and set the option to clean the ink cartridge before printing. Dennis Cheung of New Hyde Park, New York, says activating this option ruins the original StyleWriter printer's ink cartridge. Apple denies the problem, but curiously this option is not available when using the StyleWriter II 1.2 driver with an original StyleWriter printer.



Resolving System Errors

Q. I'm sure you've answered this before, but what do the different types of system errors mean? A cryptic message like "Your application has unexpectedly quit due to an error of type 3" is most un-Mac-like.

Phil Rinehart
Boston, Massachusetts

A. For the most part, the error numbers you get with "unexpectedly quit" alerts or system error alerts (the ones with the bomb icon) have no useful mean-

ing. The Mac knows something went wrong, but it doesn't know specifically what caused the trouble. Error types 1 through 14 generally indicate a software problem. It could be caused by a freak coincidence of keystrokes and mouse-clicks or by an incompatibility between two or more programs at any level (system software, extension, and application, to name a few). Types 15 through 24 and type 27 indicate a problem with the system software. The System file may be corrupted, the start-up disk may have a bad spot, or there simply may have been an ephemeral glitch on the SCSI bus. Types 25, 28, and 33 mean a program ran out of memory. A few programs keep poor track of their memory use, but even one that watches memory carefully can be caught by surprise.

Occasional bombs, freezes, and programs unexpectedly quitting are all part of Mac life. Protect against them by saving your work frequently and by backing up your disks regularly. And try really hard to be philosophical about them.

Daily crashes warrant tracking down and fixing. If you recently upgraded to System 7 or bought a new Mac and are using old software with it, be sure to

check your old software, including the driver software on old hard drives, as described in last month's *Quick Tips*. To decrease recurring memory errors with a particular program, try quitting the program and increasing the minimum memory size in its Get Info window.

To isolate a compatibility problem with extensions and control panels (which are called INITs and cdevs in System 6), restart your Mac with all extensions and control panels off. In System 7, you hold down the shift key while starting up until

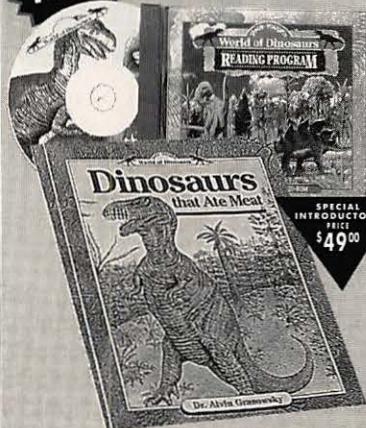
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you see the "Welcome to Macintosh" message; it should also say "Extensions Off." In System 6, you restart from your Disk Tools floppy, drag all the INITs and cdevs from the System Folder on your hard drive to the desktop, and restart from the hard drive. If the problem goes away, put the extensions on the desktop and control panels in the Control Panels folder (System Folder in System 6), and restart. If this solves the problem, the offending item is among the extensions on the desktop; if not, it is among the control panels. In either case, leave only half the group containing the offending item on the desktop and restart. If the problem occurs, the offender is among the items you just put away; if not, it is among the group on the desktop. Continue halving the offending group until you reduce it to a single item (the troublemaker).

If restarting without extensions and control panels does not eliminate the trouble, install a clean copy of the system software on your start-up drive. Before using the Installer program, drag the Finder from your System Folder to the Preferences folder and rename the System Folder "Old System Folder." This ensures that the Installer will not merely update the existing System Folder but will also create a new one. The new System Folder will have neither the preference files and private folders your applications put in the old System Folder nor the control panels, extensions, fonts, and sounds you put in the old System Folder. Move them in groups from the old System Folder to the new one, using a method similar to the one described in the previous paragraph. You may expose an incompatible item.

If you still have trouble after installing clean system software, and you have external SCSI devices, disconnect them from the Mac's SCSI port. If the problem goes away, you may have a bad SCSI cable or improper SCSI termination. If problems persist, disconnect everything from the back of your Mac except the keyboard and mouse. Also remove all expansion cards from your Mac's internal PDS and NuBus slots, if any. Reinstall add-on hardware one piece at a time, starting with the expansion cards. You may turn up a defective or incompatible peripheral.

These steps will resolve 80 percent of the recurring system crashes not caused by a faulty system board or internal hard drive. If you still experience frequent crashes, you have a few other options. The driver software on your hard drive may be incompatible with System 7; you can get the latest driver and instructions from the manufacturer of your hard drive. Zapping the PRAM (RAM that retains some con-

continues

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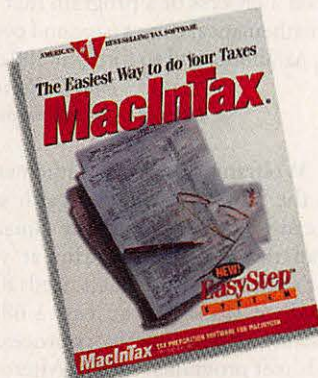
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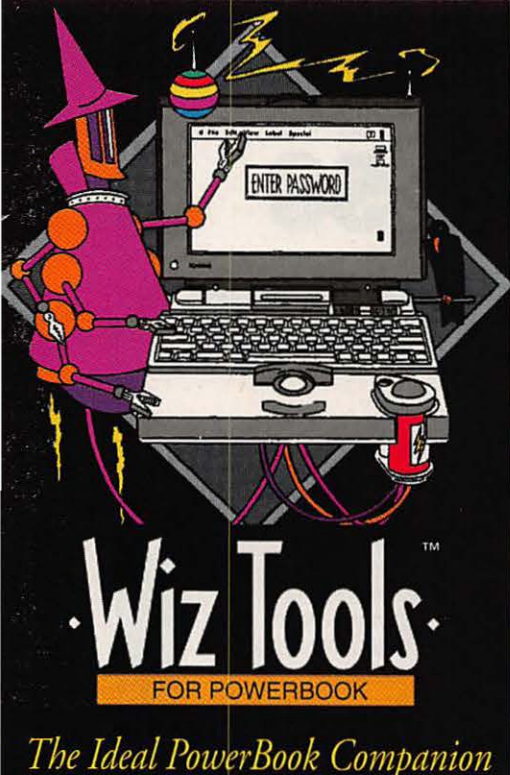
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AT WORK: QUICK TIPS

control panel settings while the computer is off) sometimes helps because it clears system settings. Hold down ⌘ -option-P-R while starting up System 7, or hold down ⌘ -shift-option while choosing the Control Panel in System 6.

Smooth Curves

Q. I frequently create mathematical curves using True BASIC, paste them into Microsoft Word, and then print them on my laser printer. The graphics copied from True BASIC print at 72 dpi on the 300-dpi laser printer. Can you recommend a process or a program that can print mathematical curves (sine and cosine waves, parabolas, and so forth) at 300 dpi?

Paul B. Robinson

Durham, New Hampshire

A. Wolfram Research’s Mathematica, the powerful symbolic math software, can graph just about any equation you can throw at it and print at your printer’s full resolution, but it needs 8MB to 12MB of RAM and at least a 68020 processor with a math coprocessor. Spreadsheet programs, such as Microsoft Excel and the spreadsheet module of ClarisWorks, have modest equipment demands and can plot an x - y line graph from pairs of data points and print it at your printer’s full resolution. (I don’t recommend Microsoft Works for x - y line graphs because you can’t easily remove data markers.) Or you can copy the spreadsheet’s chart to a word processing document and print from there. (Spreadsheet programs copy charts to the Clipboard as PICT graphics, which have no fixed resolution. The printer driver software automatically scales PICT graphics to the printer’s best resolution. In contrast, True Basic apparently copies the image as a bit-mapped graphic, whose resolution cannot be changed by the printer driver.)

One approach is to modify your True Basic program to save the data it plots (all the x and y values) in a text file. For each data point, the program should save the x value, a tab character (ASCII code 9), the corresponding y value, and a return character (ASCII code 13). When you open this text file with a spreadsheet program, all the x values will be in column A, and next to them in column B will be the y values. You plot the data by creating an x - y line chart, as explained in the spreadsheet program’s manual.

Alternatively, the spreadsheet program can calculate the data directly (unless the equation—or formula, in spreadsheet lingo—of the curve contains functions the spreadsheet program doesn’t have). You enter a list of x values

continues

HOW TO DRAW

Are you a Canvas user who’s tired of depending on clip art for pictures of people? Have good ideas but no drawing ability? Inept with the Bézier tool? Scott Edwards of Sierra Vista, Arizona, suggests you pick up a few of the books that show people and animals drawn from overlapping simple shapes. His favorite of the genre is *Cartooning the Head and Figure*, by Jack Hamm (1990, Perigee Books, 212/951-8400). You use the oval and rectangle tools to draw the shapes the book shows. Where the book tells you to erase lines, use the Outline command in the Combine submenu of Canvas’s Object menu. You can also use the Subtract command in the same submenu to cut away part of a shape; think of the underlying object as rolled, shaped dough and the overlaying object as a cookie cutter. The following steps show you how to draw a hand with this method.



1. Use the oval tool to draw the seven numbered ovals shown here. To tilt ovals 2 and 3, initially draw them orthogonally and then rotate them clockwise with the Free Rotate command in the Effects menu. As a guide to drawing ovals 4 through 7, you can draw a large oval, shown here with dashed lines, and put it behind oval 1 with the Send to Back command in the Object menu.



2. Select ovals 1 through 7 and choose Outline from the Combine submenu. If you created the guide oval behind oval 1, you can delete it now. Refine the outline by selecting it, choosing Edit Curve from the Object menu, and dragging the control points.

3. Use the freehand tool to draw the lines between the fingers and crease lines in the palm. Then select everything and set the colors and patterns for the lines and fills.



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AT WORK: QUICK TIPS

in column A either by typing each one or by using a formula to calculate them. For example, suppose you want to plot a curve with 40 x values and have each x value be 0.25 greater than the previous value. You would enter the initial x value in cell A1, enter the formula $=A1+0.25$ in cell A2, and propagate the formula from A2 through A40 with the spreadsheet program's Fill Down command. In column B you put the formula of the curve. For example, typing the formula $=\text{SIN}(A1)$ in cell B1 and then filling down from B1 through B40 calculates a sine curve for the 40 x values in cells A1 through A40. Finally you create a line chart from the data and print the chart from the spreadsheet program. For specific instructions and shortcuts on accomplishing these tasks, consult the spreadsheet program's manual.

PrintMonitor Nagging

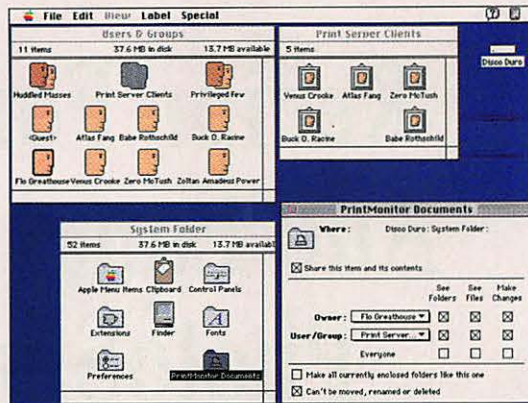
Q. A short time after I select the Print command's Manual Feed option and click OK to begin printing, an alert interrupts me with a message saying, "The printer is waiting for a sheet of paper. Please choose PrintMonitor from the Application menu." I must click OK and open PrintMonitor, only to get another alert asking me to insert paper. Because I have already placed paper in the manual-feed tray, these redundant steps are annoying. They did not appear before I upgraded from System 7.0 to 7.1. Is there a way to turn them off?

*Edward J. Cushing
Saint Paul, Minnesota*

A. Open PrintMonitor (it's in the Extensions folder) and use its Preferences command to set the type of notification you want when a manual-feed job starts: no notification, a flashing icon in the menu bar, or the alert you loathe. You can also set the type of notification you want when a printing error occurs.

Home-Brew Print Server

TIP With System 7's file sharing and the LaserWriter 8 driver, you can make any Mac a cheap, effective print server within minutes. A print server takes over the burden of background printing from client Macs. Clients get the benefits of background printing without the drag on foreground tasks. The server and client Macs must all have System 7 and LaserWriter 8 installed and be connected in a network (such as PhoneNet,



Print-Server Setup Make any Mac a LaserWriter 8 print server by installing LaserWriter 8 software, turning on System 7's file sharing, creating user icons and a group for client Macs, and sharing the server's PrintMonitor Documents folder.

LocalTalk, EtherTalk). Unfortunately, the LaserWriter 7 drivers will not work. You can get LaserWriter 8 software for \$24.95 from Apple's software order center (800/769-2775, ext. 7873), or by modem from AppleLink, America Online, and other information services.

On the Mac that will be the print server, use the Sharing Setup control panel to start file sharing. Open the Users & Groups control panel and make sure it contains a user icon for each Mac that will be a client of the print server; create user icons with the Finder's New User command. Then create a new group icon, name it Print Server Clients, and drag the user icons of all client Macs to the new group icon. Next open the System Folder and use the Finder's Sharing command to set access privileges for the PrintMonitor Documents folder. For optimum security, turn off all privileges at the Everyone level (thus disallowing guest access), turn on all privileges at the User/Group and the Owner levels, set the User/Group to Print Server Clients, and turn on the option "Can't be moved, renamed or deleted." For examples of the Users & Groups control panel and the access privileges window of the PrintMonitor Documents folder, see "Print-Server Setup."

On each client Mac, use the Chooser to share the server's PrintMonitor Documents folder or the disk that contains it, whichever is named in the Chooser's list of sharable items. Make an alias of the server's PrintMonitor Documents folder, change the alias's name to PrintMonitor Documents, and drag the alias to the client's System Folder so it replaces the PrintMonitor Documents folder there. If the client Mac tells you its PrintMonitor Documents folder is locked when you try to replace it, use the client's Sharing Setup control panel to stop file sharing (you can

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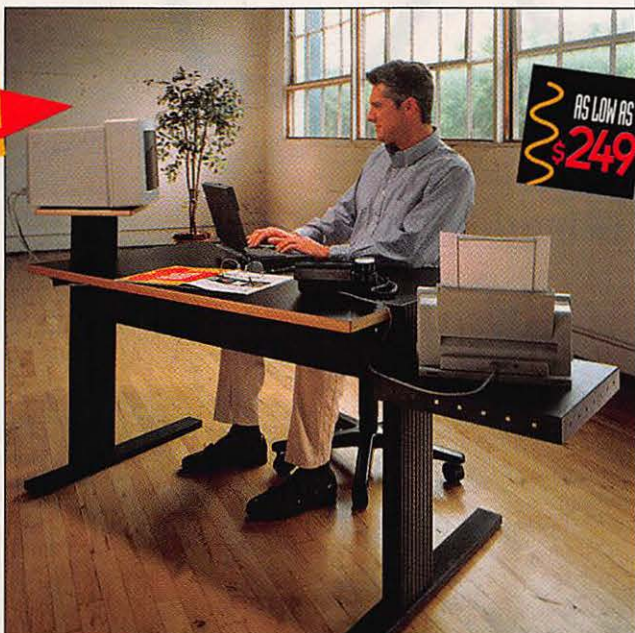
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start it up again after replacing the Print-Monitor Documents folder with the alias). If you like, you can copy the icon from the Get Info window of the client's PrintMonitor Documents folder before replacing it, and then paste the icon into the Get Info window of the alias. From now on, the client will automatically forward print jobs to the server.

*Milo Sharp
Fairbanks, Alaska*

If the print server is not available (for example, if it is turned off), then the client cannot forward print-spool files. When the server becomes available, look in the client's System Folder for files with names like PS Spool File 1 and drag them to the PrintMonitor Documents alias. The Finder copies the files across the network to the server, and then you can drag them to the client's Trash.

To have a client Mac resume handling its own background printing, simply drag the PrintMonitor Documents alias out of its System Folder. The client will automatically create a new PrintMonitor Documents folder the next time it prints.

It is possible to set up a print server with LaserWriter 7 and even StyleWriter software, as several readers have remarked. Frankly, though, it's not worth the effort; just upgrade to LaserWriter 8 or use the StyleWriter upgrade kit described at the beginning of this month's *Quick Tips*.—L.P.

Lively Page-Layout

TIP Tired of the same old page-layout routine? Let QuarkXPress 3.2's robot zap your deletions. Select an object you want deleted and press option-delete (or ⌘-option-K).

*Stan McCoy
Albuquerque, New Mexico*

Waking Somnolent PowerBooks

TIP If your PowerBook occasionally refuses to awake from sleep mode, try unplugging the AC cord from the PowerBook, plugging it back in, and pressing any key. This always works for my somnolent PowerBook 140, which resists awakening several times a week.

*T. David Gordon
Nashua, New Hampshire*

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** Minimum requirements: 386 and Windows 3.1, 4MB RAM. Mac Plus/Classic or higher, 4 MB RAM.

Circle 97 on reader service card

EDITED BY ELIZABETH DOUGHERTY

Networks

THE LATEST IN CONNECTIVITY AND COMMUNICATIONS

Revamped ARA Hits the Road

ROAD WARRIORS AND NETWORK ADMINISTRATORS rejoice: Apple has overhauled its AppleTalk Remote Access (ARA) software, splitting it into clients and servers that offer easier use, better administration, tighter security—and, eventually, support for non-Macintosh computers.

The original ARA's combination client-and-server software allows any Mac to dial in to any other Mac running the software. Once logged on, the remote Mac behaves like a local AppleTalk network node, accessing network resources through the Chooser and advertising its own services to the rest of the network, though at slow modem speeds. ARA 1.0 requires users to install the client-server combination on every Mac, regardless of what function the Mac performs.

Rechristened at its November release as Apple Remote Access, the software now consists of a separate client and two different servers.

Apple Remote Access MultiPort Server for Macintosh (suggested retail price \$1799) is the new top-of-the-line ARA offering. ARA MultiPort Server lets managers adjust password length, force password changes, adjust the number of invalid log-on attempts allowed before locking out a user, hide network zones from specific users, set limits on individual connection time, and disable clients' Save Password option to keep unauthorized users off the network.

In addition, Security Dynamics and other security software and hardware makers have said they will take advantage of ARA's new modular design to integrate their authentication schemes into the server to augment its built-in password and call-back measures.

ARA MultiPort Server administrators can disconnect any client at any time, set log-on greeting messages, and send



broadcast messages to attached clients, in addition to monitoring some server functions through the Simple Network Management Protocol (SNMP).

Supporting up to 16 simultaneous connections, ARA MultiPort Server comes with a NuBus serial card, modem cable, and software to support four modems and four clients. Expansion kits (suggested retail price \$1499) support four more modems and users.

A drop-in software extension for the high-end server, to be sold separately in spring 1994, will let users connect via an X.25 network. The price was not set at press time. An ISDN extension is planned by another company, said Apple officials.

Non-AppleTalk users will eventually be able to dial in to their own networks through an Apple Remote Access server. Apple said it will support both NetWare

IPX and TCP/IP using the Point-to-Point Protocol (PPP), but hasn't announced availability or pricing.

The low-end server option, Apple Remote Access Personal Server for Macintosh, is a single-line server suitable for a small workgroup or an individual, with a suggested list price of \$249. Functionally almost equivalent to ARA 1.0, the new server does allow users to change their own passwords, a task formerly reserved for network managers. This server comes with one copy of the client software.

The client program, Apple Remote Access Client for Macintosh, lets Macs dial in to any ARA-compatible server. (ARA 1.0 users, however, can't access the new servers through their software.)

The client's new control panel, Dial-Assist, can be configured to insert the cor-

rect dialing codes when PowerBook users move from place to place. ARA Client users can also display a blinking icon reminding them they are online. A new extension lets them break the remote connection from within any application.

The suggested retail price for ARA Client for Macintosh is \$69, \$599 per ten-pack. ARA Client ships free with new PowerBooks; site licenses are available.

—MARGIE WYLLIE

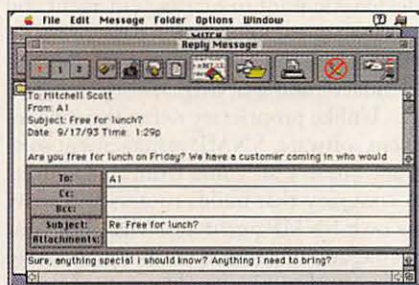
DaVinci Repaints Mac E-mail

DAVINCI SYSTEMS CORPORATION, known for its NetWare MHS-based E-mail applications for DOS and Windows PCs, plans to finally start shipping a Mac version of its popular DaVinci eMail in the first quarter of 1994. DaVinci eMail for the Macintosh 2.5 is a cross-platform E-mail application that lets Mac and PC users on the same NetWare network exchange messages and access mailboxes from either type of computer.

The Mac version offers the same features, administrative functions, and security as the company's DOS and Windows versions. All versions use the same E-mail engine, database, and messaging technology. The Mac version includes a few new features, such as balloon help and built-in viewers, to make it familiar to Macintosh users. Pricing for the Mac edition was not available at press time.

DaVinci eMail for the Macintosh is designed primarily to bring E-mail services to the maverick Macintosh user plugged into a network of PCs, but it can also be used to set up an E-mail system on an all-Apple network running NetWare for Macintosh. In either case it must be installed on a dedicated PC server running NetWare.

DaVinci Systems (919/881-4320) will discontinue DaVinci MacintoshAccess; customers can upgrade to DaVinci for the Macintosh.—MARTHA STRIZICH



DaVinci eMail for the Macintosh lets users swap messages with any other Mac or PC on the same NetWare network.

Ethernet via SCSI

MOST EXTERNAL ETHERNET ADAPTERS must be plugged into an electrical outlet, but not Sonic Systems' compact microSCSI, which weighs 5 ounces and is a little bigger than a pack of cigarettes. The two microSCSI models—one for PowerBooks (\$449) and one for desktop Macs (\$399)—plug into an Apple Desktop Bus (ADB) port and draw power through the port. Both models include an ADB pass-through port in case you have several ADB devices to plug in.

Available now, the microSCSI adapters come with both thick and 10BaseT connectors. Sonic Systems, 800/535-0725 in the United States and Canada.—MARTHA STRIZICH



For users on the go, Sonic Systems' compact microSCSI Ethernet adapters draw power through the ADB port, eliminating the search for an electrical outlet.

New Fast-Packet Gear Links LANs

INTERESTED IN HIGH-SPEED WAN SERVICES, but can't justify costly T-1 access? Try low-speed switched multi-megabit data service (SMDS) and frame-relay service.

Available in large metropolitan areas since 1991, SMDS is touted as a cost-saving alternative to private leased-line networks. Still, the connectionless service of up to 45 Mbps is an expensive way to ferry LAN traffic across the public telephone network. So some telephone carriers such as Pacific Bell are offering lower-speed SMDS services—64 Kbps or 56 Kbps, versus the previous minimum of 1.17 Mbps—at more affordable rates.

MultiAccess Computing Corporation has developed a synchronous communications adapter card to let Macintosh users take advantage of the new services. The SMDSTalk/DS0 NuBus adapter

IN BRIEF

NetWare Mac Remote

Novell has integrated remote dial-in and shared dial-out capabilities, including AppleTalk, in NetWare Connect, a NetWare Loadable Module (NLM) for NetWare 3.X or 4.X that replaces NetWare Asynchronous Communications Services. It supports up to 64 communications ports on a single server, including X.25 and ISDN access ports. \$595 for 2 ports, \$2195 for 8 ports, \$5995 for 32 ports. 801/429-7000.

Mail Call at CompuServe

Now that CompuServe Information Service's Mail Hub supports SMF-71 (the latest version of Novell's Application Programmer's Interface, which is built into NetWare Remote MHS 2.0), corporate networks can use CompuServe as a link in E-mail distribution systems. Diverting E-mail users to a commercial service could help unjam network bottlenecks because people who need remote access to other network resources don't have to compete with coworkers who are just checking their mailboxes from home, a field office, or a hotel. 614/457-8600.

LocalTalk Links to Token Ring

Dayna Communications is shipping two bridges that connect LocalTalk printers, Macintosh computers, network modems—essentially all LocalTalk devices except routers—to Token Ring networks. TokenPrint (\$1099) connects one or two LocalTalk devices to Token Ring Type 1 or 3. TokenPrint Plus (\$1399) can handle up to four LocalTalk devices. 801/269-7394.

connects to any standard 56-Kbps CSU/DSU to provide point-and-click access to SMDS for individual Macs or Macs connected to AppleTalk networks.

The company's MCC-256FRS, a synchronous communications adapter card, lets Macs connect to frame-relay services at 56 Kbps. A streamlined version of X.25 packet switching, frame relay works well for LAN traffic that comes in bursts.

Both \$1195 cards are scheduled for release by the end of 1993 and include software. MultiAccess Computing, 805/964-2332.—MARTHA STRIZICH

SNMP

WHAT THE SIMPLE NETWORK MANAGEMENT PROTOCOL CAN DO FOR YOU

REVEALED

Quick, no peeking: how many different brands of equipment does your network include? Did you remember all those different hubs? Ethernet cards? Servers and routers? If you ran out of fingers before you ran out of equipment, now is the time to think seriously about centralizing your network management.

Every hub, router, and server on the network comes with its own management program. Each tool works beautifully with the equipment it's designed to manage, but not at all with everything else. So managers can end up with a hard disk full of tools and no coherent picture of the whole network. Which vendor made the hub on the third floor? Is there a bridge in the computer room, or is it a router? Does that printer support TCP/IP?

SNMP, the Simple Network Management Protocol, is one way to break out of using proprietary network-management tools and get a grip on your network. But while the SNMP vision is simple in theory—one management protocol, one management station, many different devices—in practice, implementing SNMP can be tricky, especially on a Macintosh network.

Originally created for TCP/IP networks, SNMP management software is just beginning to appear for AppleTalk and for the Mac. That not only limits how useful SNMP can be on your Mac network today, but it means you have to shop carefully for software that works in your environment.

Despite any complications, SNMP promises to eventually unite not only your diverse Macintosh network under a single management station, but also your entire multiplatform network. So even if SNMP isn't for you now, if your net-

work is growing, it's important to keep a finger on the pulse of this network-management standard.

To find out how useful Mac-based SNMP software is today, I tested four network-management software packages that use SNMP: Caravelle's NetWorks, InterCon Systems' WatchTower, Neon Software's LANsurveyor, and Network Resources' MultiGate Manager. I also tested a sample of Mac network devices and software that support SNMP over AppleTalk and TCP/IP. But first, some background.

SNMP Background

SNMP was invented in the late 1980s to help manage the Internet, the TCP/IP-based research and academic network; the protocol has since become a de facto standard for network management. In theory, SNMP allows any management station that speaks SNMP to monitor and control any network device or computer that understands SNMP. In practice, it's a little more complicated.

SNMP requires three pieces of software: one for the administrator (network-management software), and two for each device you want to manage (an agent and a management information base, or MIB). (For more on agents and MIBs, see "Understanding SNMP.")

Unlike proprietary network-management software, SNMP management software doesn't all come from one source. A company that builds routers will write its own SNMP agent and MIB, but your management station is likely to come from another source. The management station and device software will not work together unless both use the same transport protocols.

The Problem of Protocols

Originally, SNMP only ran over a TCP/IP protocol stack, using UDP as the transport protocol. For a network node, router, hub, or server to be included in an SNMP management scheme, the device had to be running TCP/IP. Although TCP/IP is still by far the most widely used transport for SNMP, there is nothing inherent in SNMP that requires it to run over TCP/IP. Today, SNMP's popularity has led to standards for running SNMP over AppleTalk's DDP protocol (and others, such as Novell NetWare's IPX and pure Ethernet).

So when you are looking for SNMP-manageable equipment, it's not enough to know that a device supports SNMP. You must also find out whether the underlying protocol stack is compatible with your diagnostic and management software (see "What You Can Manage with SNMP" to find out what protocols major Mac equipment supports).

SNMP over AppleTalk

In theory, running SNMP over AppleTalk should allow you to manage any AppleTalk network through any SNMP-

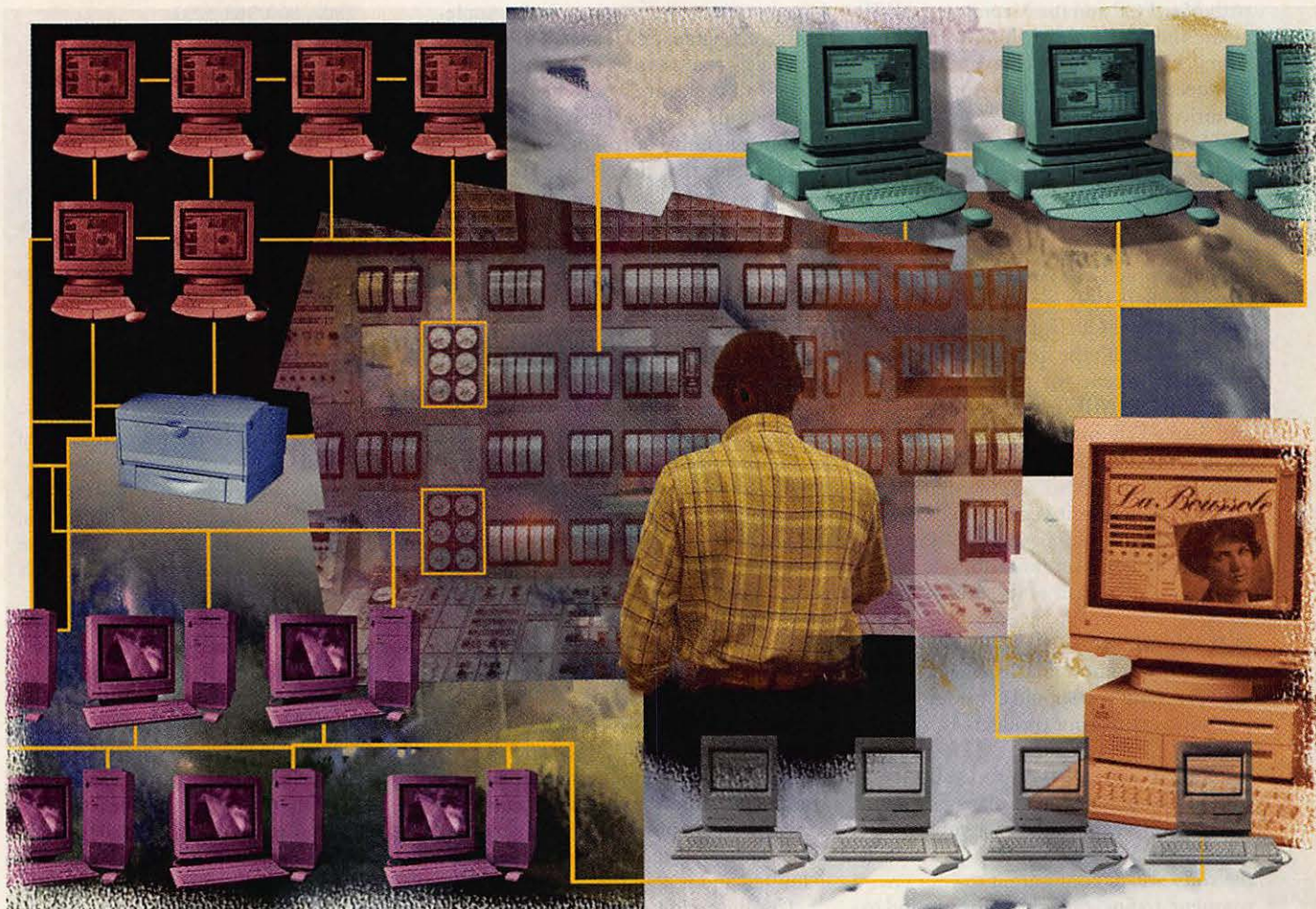
based management-station software. While some Mac network devices can be monitored and controlled using SNMP over AppleTalk, you currently have to use a Macintosh-based management station. (At press time, none of the major management stations, such as Hewlett-Packard's OpenView or Sun Microsystems' SunNet Manager, both Unix-based, supported SNMP transmission via AppleTalk.)

And while Mac-based management stations can pick up and send SNMP messages via other protocols, such as TCP/IP or Novell NetWare's IPX, Mac software packages aren't yet as sophisticated or as powerful as their Unix-based cousins. So they can't always interpret the information they receive or control SNMP-compliant network devices very elegantly.

Therefore, a large network with both TCP/IP and AppleTalk SNMP devices could require two different SNMP-based management stations, which thwarts the purpose of using SNMP to centralize network management.

SNMP 2, a new transport-independent version of the standard, is supposed

BY JOEL SNYDER



to solve this problem by making it possible for all SNMP stations to communicate with all SNMP-compliant network devices. Still, it's not expected to be widely available for another couple of years.

Managing Macs with SNMP

Apple introduced four SNMP software packages last year that allow you to manage and monitor networked Macintoshes remotely, assuming your management station is smart enough.

TCP/IP Connection for Macintosh (\$59) consists of MacTCP 2.0.2, as well as the SNMP-over-TCP/IP agent and Macintosh MIBs. The SNMP agent and MIB let you fetch information, such as the system version or hard disk capacity, from a Macintosh running MacTCP, Apple's TCP/IP protocol stack.

TCP/IP Administration for Macintosh (\$199) includes the same software as TCP/IP Connection, along with applications to configure MacTCP and the Macintosh SNMP agent, some additional documentation, and a TCP Ping program—at last!

Apple lets a network manager buy one copy of the TCP/IP Administration product and use that to create floppy disks with MacTCP and the Macintosh SNMP agent and MIB to distribute to TCP/IP users. Each user must have a TCP/IP Connection license (which Apple sells in quantity at a discount).

AppleTalk Connection for Mac (\$39) brings Apple's newest AppleTalk stack and its SNMP-over-AppleTalk agent and MIBs to the AppleTalk-connected Macintosh. With extra tools and documentation, AppleTalk Administration for Macintosh (\$199) works on the same model as the TCP/IP package.

Apple wasn't the first to come up with an SNMP agent for the Mac, but by including SNMP in the basic TCP/IP and AppleTalk packages, Apple is trying to promote SNMP as the standard way to manage Macs. Also, AppleShare Pro servers can transmit very limited data to an SNMP workstation via TCP/IP today. Apple is working on more fully featured SNMP agents for all of its servers.

Is It Worth It?

Now that you know a little about SNMP, the next thing you should consider before you start comparing products is, do you need it?

SNMP can save you time and frustration, but only if you're managing a big network. SNMP requires a substantial investment of time on your part, to learn the software, to configure it to your environment, to fine-tune the software, and to make use of the data you collect.

In other words, if your network consists of five Macs and a LaserWriter, SNMP is not for you. But if you have a growing, expanding, and/or multiprotocol network, chances are you will need SNMP, if not now, then in the future.

Management Stations: What to Expect

Most network-management stations have two main functions: monitoring and configuration. A station monitors a network by periodically polling each device and taking action if there's a problem. Some stations simply test reachability; for example, is the device still up and running? Others can make more sophisticated queries, checking error rates, throughput, and other significant indicators of network health.

When there's a problem, the management station can take different actions: it can write to a log file, sound an audio alarm (like a beep or recorded sound), send E-mail, or even page the network manager with the bad news.

Management's other task is configuration. As you add new devices to the network, and as the network status changes, you must also change the factory defaults. One common configuration is the AppleTalk zone name: newly installed Phase 2 AppleTalk routers must be told what their AppleTalk zones are before they are used. Bear in mind, however, that management stations can only control network devices to the extent that their agents and MIBs will allow. (See "Understanding SNMP" and "What You Can Manage with SNMP" for more information.)

WatchTower InterCon Systems Corporation's WatchTower (\$2495) is a bare-bones SNMP management station for the Macintosh. WatchTower supports SNMP only over TCP/IP.

WatchTower begins the way a good SNMP management station should, by letting the network manager draw a simple map of the network. But the program doesn't do much more than that. Network monitoring is severely restricted. No automatic device polling is available; if you want to see whether a device is up and running, you have to double-click on the device icon each time.

WatchTower does construct some graphs that show trends for TCP/IP nodes. But you can track only five variables (TCP and UDP input and output rates, as well as IP input rates), and that's not much help. WatchTower can also construct real-time bar graphs showing some traffic, but the choices are extremely limited and not all that useful.

Configuration is even more restricted. To configure a device using Watch-

Tower, you must know the exact SNMP variable to change and its legal values.

I thought this version of WatchTower was fun to play with, but it wouldn't be helpful to a network manager trying to keep an eye on a large network. Aside from the bugs (for example, displaying two graphs at the same time caused WatchTower to go wacko), this version simply lacks the functions needed in a network-management station. And it certainly isn't worth the high price.

NetWorks Caravelle Networks Corporation's NetWorks (\$995) knows about much more than just SNMP. Originally designed to watch over an AppleTalk network, the newest release, version 3.0, can

WHERE TO BUY

LANsurveyor 1.01 Five zones \$395; unlimited zones \$695; Neon Software, 510/283-9771.

MultiGate Manager 5.1 \$2995 (enterprise version); Network Resources Corp., 408/383-9300.

NetWorks 3.0.2 \$995; Caravelle Networks Corp., 613/596-2802, 800/363-5292.

WatchTower 1.0.4 \$2495; InterCon Systems Corp., 703/709-5500, 800/468-7266.

monitor a network of computers and devices that talk AppleTalk, Novell NetWare's IPX, Digital Equipment Corporation's DECnet, TCP/IP, and SNMP over both TCP/IP and AppleTalk. NetWorks, however, is only a monitoring tool; it doesn't support any network configuration (or Set) functions.

The NetWorks approach to monitoring is based on a device list and a list of notifications. The device list is made up of virtually anything on the network: hubs, routers, workstations, printers, modems. Unfortunately, you must make the list yourself, one device at a time; it's a time-consuming process.

NetWorks checks the devices on the list as often as you specify. If there's a problem, NetWorks activates a notification from another list.

NetWorks can notify you of problems in a variety of ways, including displaying a dialog box on the Macintosh screen; using MacinTalk to speak a message; playing a recorded message or sound; sending a message to a pager; sending a message via modem to another computer or bulletin board (such as CompuServe); and sending mail using

The SNMP model for managing networks is based on three basic pieces of software: agents, MIBs (management information bases), and management stations.

Agents are pieces of software that run at each network device. They fetch information stored in a database called a management information base, also stored at the device.

Management stations let you retrieve and display information gathered from a device's agent and MIB. Occasionally, management stations can also control (or *Set* in SNMP terms) those devices. Most management stations today run on Unix-based workstations, but more software is appearing for the Mac.

Each entry in a MIB is called a MIB variable. For example, one common MIB variable for the Macintosh is *sysDescr*, which describes system hardware and software. If you use a management station to retrieve (*Get* in SNMP terms) the *sysDescr* variable for a Macintosh, you'll get an answer like "Macintosh Quadra 800, System 7.1."

Depending on how sophisticated your network-management station is, you may have to request each bit of information about different network devices sep-

arately, or you may be able to issue many requests at once. Likewise, the way the information is displayed and interpreted will depend on your software management station.

You can also store information that the SNMP agent can't gather from your computer in a MIB variable. For example, you might *Set* the *sysLocation* variable on a particular Macintosh to be Building 73A, Room 117. A manager who later requests that variable will find out where the system is located.

Besides the basic *Get* and *Set* operations, SNMP supports *Traps*, event notifications sent by a network device's agent to the management station. Traps help managers to keep an eye on the network without constantly asking every device for status information. For example, one trap is the *ColdStart*, which a router's agent sends out every time the router boots up. Again, what a management station does when it receives a trap varies. It might simply note the information in a file or send the administrator an E-mail or a pager message, or the trap might trigger some other action, such as downloading device-configuration information.

There are many kinds of MIBs defined for SNMP. The basic MIB, called

MIB II (it replaced MIB I) includes a basic set of variables for any network device. Most vendors support all or part of the standard MIB, but many vendors also define a private MIB that works only with their equipment. Private MIBs usually include special statistics or configuration options that aren't defined in the MIB I or II. Not every management station works with every private MIB.

Most network devices support more than one MIB. For example, Apple's SNMP agent for the Macintosh supports almost all of MIB II, an AppleTalk MIB, and a new MIB called the Macintosh System MIB. The Macintosh System MIB is a private MIB that reports extensively on nearly every aspect of the Macintosh, including:

- file information for all files in the System Folder
- information about all applications on the system
- type of NuBus cards attached
- SCSI devices attached
- all managed services (like an E-mail server) on the computer
- volume information for all mounted volumes
- information about the currently selected printer.

QuickMail, Microsoft Mail, Simple Mail Transfer Protocol (a Unix-based E-mail system), or Apple's new AOCE (Apple Open Collaboration Environment) mail included in System 7 Pro. That's an impressive list of choices.

Using NetWorks, the administrator can keep a close eye on a very large, multi-vendor network. I configured NetWorks to query a particular MIB variable in one network router every 30 seconds and play a recorded message on the Macintosh if the router went over a certain threshold ("Hey, the router is real busy now"). I also instructed NetWorks to page the network manager if the router went too deeply into the danger zone. Because NetWorks supports both numeric and alphanumeric pagers, a network manager can actually see the router name and the traffic level in the pager message.

LANsurveyor Neon Software's LANsurveyor (\$395 for five zones, \$695 for unlimited zones) is an AppleTalk mapping and monitoring tool that can use SNMP over AppleTalk. LANsurveyor's forte is map drawing. Set it loose on an AppleTalk network and LANsurveyor will find all of the routers, pick appropri-

ate icons, and try to lay them out into a logical map of the network. Masochists can ask LANsurveyor to find every AppleTalk node, not just routers.

Once you've built a map with LANsurveyor, getting information out of the SNMP MIB is easy. Double-click on a device icon and up comes a window that lets you look at that device's AppleTalk information, SNMP MIB information, and notes and comments that you may have added to the map.

LANsurveyor has fewer monitoring and notification options than NetWorks. LANsurveyor will watch over a list of network devices and send notifications if a device becomes unavailable or if AppleTalk traffic error rates go above a threshold you define. You can send notifications in a variety of ways, including writing to a log file, displaying a dialog box, and making other visual changes to the map; playing sounds; sending pages; or sending mail via QuickMail.

One nice feature of LANsurveyor is its linkage to other Mac applications. You can associate any device with a Macintosh application. Then you can option-double-click on the device's icon to

launch that application. I used this feature to link Compatible Systems Corporation's configuration utility to its RISC-Router 3000E.

Without a doubt, the coolest part of LANsurveyor is its automated network-mapping capabilities. I took LANsurveyor to an AppleTalk network with several hundred nodes, and let it rip. Minutes later, I had a full map of the network, complete with device names, links between routers, and other useful information.

Neon Software also makes Router Check (\$895), a complementary tool that helps keep an eye on AppleTalk routers using SNMP-over-AppleTalk, as well as several different proprietary management protocols supported by the routers.

MultiGate Manager The most bug-ridden of the products I reviewed, Network Resources Corporation's MultiGate Manager (\$2995) still has the potential to be a powerful network monitor. Its good use of color and graphics brings many of the features of larger SNMP management stations to the Mac.

The software does not draw network maps, but it lists TCP/IP network devices

What You Can Manage with SNMP

Company	Phone	Agent	Device Type	MIBs Supported	Transports	Get/Set
Apple Computer	408/996-1010, 800/732-3131	TCP/IP Connection for Macintosh	Macintosh	MIB II, Macintosh System MIB, AppleTalk MIB	UDP	●/●
		AppleTalk Connection for Macintosh	Macintosh	MIB II, Macintosh System MIB, AppleTalk MIB	DDP	●/●
APT Communications	301/831-1182	ComTalk HF, HX	router	MIB II, AppleTalk MIB, AppleTalk MIB II, Ethernet MIB, Generic Interface MIB	UDP, DDP, Ethernet	●/●
Asanté	408/435-8388, 800/662-9686	AsantéHub 1012, AsantéBridge 1012	Ethernet hub	MIB I, MIB II (subset), Asanté MIB, Ethernet Hub MIB, Bridge MIB	UDP	●/●
		AsantéHub 2072	Ethernet hub	MIB I, MIB II (subset), Asanté MIB, Ethernet Hub MIB	UDP	●/●
Cayman	617/494-1999	GatorStar HR	router/Ethernet hub	MIB II, AppleTalk MIB, Ethernet MIB, Cayman MIB	UDP, DDP	●/○
		Gatorbox EX, CS, GX	router	MIB II, AppleTalk MIB, Ethernet MIB, Cayman MIB	UDP, DDP	●/○
Compatible Systems	301/931-1182, 800/842-0626	EtherRoute-TCP II	router	MIB II, AppleTalk MIB, AppleTalk MIB II	UDP, DDP	●/○
		RISCRouter 3000E	router	MIB II	UDP, DDP	●/○
Farallon Computing	510/814-5000	InterRoute/5	router	MIB II, Farallon Common MIB, IF Extensions MIB, AppleTalk MIB, Ethernet MIB	UDP, DDP	●/●
		StarRouter	router/LocalTalk hub	MIB II, Farallon Common MIB, Farallon StarRouter MIB, AppleTalk MIB, IF Extensions MIB	UDP, DDP	●/●
		Ether 10-T StarController	Ethernet hub	MIB II, IF Extensions MIB, Ethernet MIB, AppleTalk MIB, Farallon Common MIB, Ether 10T StarController Private MIB, 802.3 Repeater & MAU MIB	UDP, DDP	●/●
Network Resources	408/383-9300	MultiGate Hub 2	Ethernet hub	MIB II, Repeater MIB, Bridge MIB, PPP MIB, Ethernet MIB, MAU MIB, RS-232 MIB, NRC Hub2 MIB	UDP	●/●
		MultiGate Hub	Ethernet hub	MIB II, Repeater MIB, Bridge MIB, NRC Hub MIB	UDP	●/●
		MultiGate Hub 1/1+	Ethernet hub	MIB II, Repeater MIB, Bridge MIB, Ethernet MIB, MAU MIB, RS-232 MIB, NRC Hub1 MIB	UDP	●/●
Shiva	617/270-8300, 800/458-3550	FastPath 5R, FastPath 5	router	MIB II, AppleTalk MIB, Ethernet MIB, Shiva MIB	UDP, DDP	●/●

● = yes; ○ = no.

Listed here is a sampling of the different ways Macintosh networking companies support SNMP. Before you buy a network-management station, make sure it supports the same transports and MIBs as your networking equipments' agents. While most agents ship free with hardware, Apple sells its Mac agents separately.

in tabular format, along with device interface status, network addresses, any device traps, and an alarm status field. (It doesn't support SNMP-over-AppleTalk.)

MultiGate Manager keeps an eye on your network in two ways. Devices in the network manager window are polled at whatever rate you specify. If a device becomes unavailable, you'll see that on the display. The display also shows the status of hubs and routers by displaying a series of dots by each device, one per interface. If the interface is up, the dot is green; if down, the dot is red.

Trend/threshold windows let you continuously monitor the network through strip charts showing SNMP variables from one or more devices. For example, a strip chart showing the throughput of each port on a router shows which attached network is experiencing the heaviest load.

MultiGate Manager can use Apple events to send alarms through Ex Machina's Notify pager software. For example, the software can page you with the message "server disk nearing capacity" if the

AppleShare server's free disk space falls below 1MB. Plus you can search for TCP/IP devices by network number. The software also lets you view and set individual MIB variables.

What to Do?

Now that SNMP is becoming an effective way to watch over your network, what—or if—you should buy depends on your needs. That's why I can't really recommend one Mac SNMP product over the others. If you have a small network, don't do anything. You've probably got all the AppleTalk-based tools you need to keep everything under control. (Proprietary tools such as TechWorks' GraceLAN Network Manager, for software updates, and Asanté's AsantéNet, for monitoring Asanté hubs, are better choices.)

If SNMP is in your future, set your sights low and check out Caravelle's NetWorks. As a monitoring tool, it does the best job of the products tested. And it lets you mix SNMP and other systems such as AppleTalk in the same monitoring station. That way, you don't have to jump

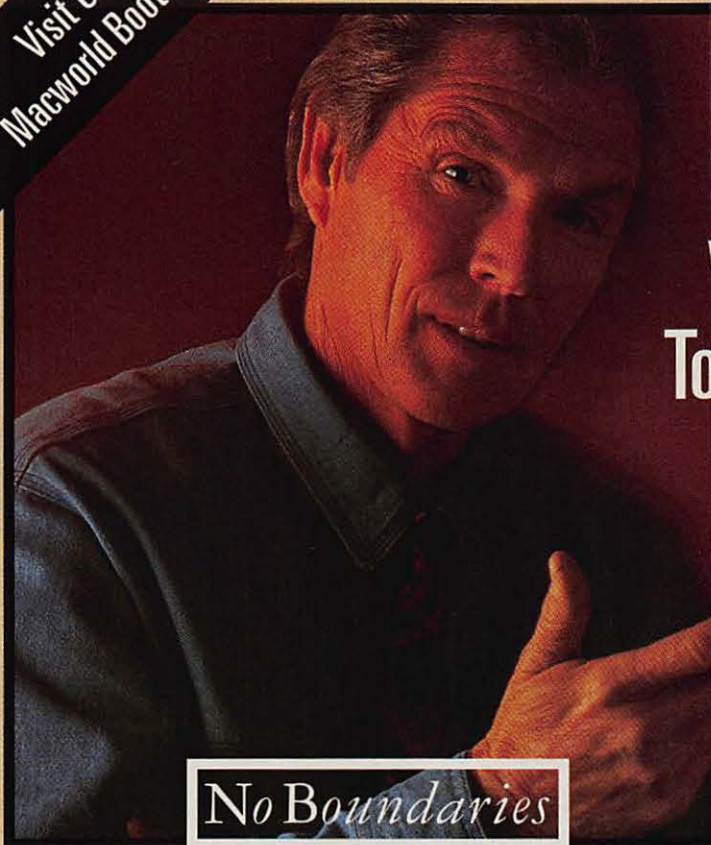
into SNMP agents for everything right away; you can take advantage of SNMP's features as they become available.

If you're in an AppleTalk-only environment, Neon Software's LANsurveyor draws high-quality network maps and notifies you if an AppleTalk node becomes unavailable. But a really useful program would be a cross between LANsurveyor and NetWorks, offering both automated network mapping and sophisticated, multiprotocol monitoring.

Macintosh versions of the SNMP management stations still have a way to go. If you want a full-fledged management station, you're going to have to leave your Macintosh desktop behind and jump into a Unix-based or OpenVMS-based product. Although both MultiGate Manager and WatchTower show promise, neither one is ready for a production network environment. ■

JOEL SNYDER is senior analyst with Opus One, a consulting firm in Tucson, Arizona. He specializes in networks and the international aspects of information technology.

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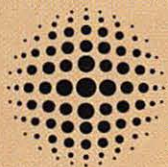
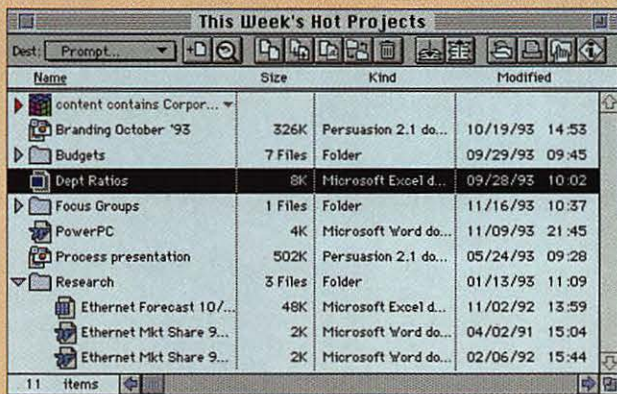
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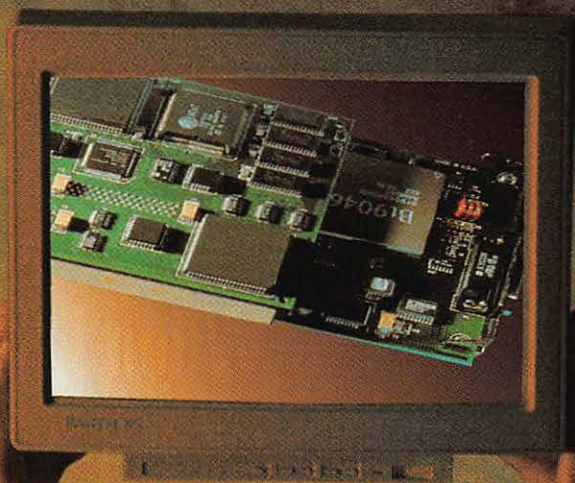


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PowerBook

Notes

Printing on the Run

THE ONE MAJOR SYSTEM COMPONENT A traveling PowerBook user typically leaves behind is a printer—for obvious reasons: its weight and bulk. But what can you do when you're on the road and you really need a printout? You could connect your PowerBook to a printer at the site you're visiting—provided there's a printer available *and* you have the right printer driver software and cables. You could fax the pages to yourself, but due to their 200 dots per inch (dpi) and the flimsy thermal paper they usually come on, fax images rarely look good. To make matters worse, many hotels and commercial fax services charge outrageous rates for receiving a fax—often a dollar a page—and your document is no longer private.

Now there's a better alternative. Five portable, battery-operable printers debuted in 1993. These models are far superior to earlier portables, which had fewer features or were pricier (see "Portable Printers Compared").

How They Work

Three of the printers (the DoveWriter 1 Portable, the Citizen Notebook Printer II, and the Mannesmann Tally MobileWriterPS) use thermal transfer or thermal fusion—a process in which the printing head heats up and bonds a resin ink onto the paper. The other two (the HP DeskWriter 310 and the Apple Portable StyleWriter) are ink-jet printers; they squirt tiny droplets of ink onto the paper.

All the printers can run on batteries; both the DeskWriter and the DoveWriter use standard camcorder batteries (check carefully; some camcorder batteries look the same but have incompatible connectors or shapes). None of the printers can use a PowerBook battery or power supply. All print quietly; you can easily carry on a conversation while printing.



Size, Shape, and Weight

With one exception—the DoveWriter—the size and shape of each printer pretty much demands its own carrying case or a large carrying case for the PowerBook with a special printer compartment. The Citizen and Dove printers are roughly half the bulk of the other three. The Citizen is the smallest and lightest, but its brick shape does not fit easily into a shoulder bag with a PowerBook. Because of its unique design, the DoveWriter unfolds into a flat, 1-inch-thick notebook shape for carrying, so it fits into many carrying cases along with a PowerBook. For protection against scratches, it comes with a simple plastic slipcase, much like Apple's protective cases for PowerBook batteries. The MobileWriterPS may be the heaviest at 9.5 pounds, but it is the only PostScript printer. (If you can put up with very slow printing, Freedom of Press Classic—\$149, from ColorAge, 508/667-8585, 800/437-3336—can do PostScript processing on your PowerBook and send the image to a QuickDraw printer.)

Printing Speed

In my own speed tests, the DeskWriter 310 won by a considerable margin, producing 1.67 pages per minute, the same speed as a desktop DeskWriter. The Apple Portable StyleWriter and MobileWriterPS could each manage almost a page a minute, about the speed of the original (discontinued) desktop StyleWriter. The Citizen trailed and the DoveWriter brought up the rear at only a fifth the speed of the DeskWriter. None of these printers are fast enough to compete with even a low-end laser printer.

Sheet Feeders

Faster printing is preferable, of course, but a sheet feeder can make waiting for a slow printer more tolerable by letting you do something else while the printer works. Of the portable printers, only the Citizen and MobileWriterPS have built-in sheet feeders. The Citizen's 5-page feeder isn't capacious, but reloading every 5 pages beats feeding in single sheets; the Citizen also accepts an optional external 30-page feeder. With its internal 80-page feeder, the MobileWriterPS doesn't need an external feeder. The remaining printers accept optional external sheet feeders, but these are all so bulky that you'll probably leave them behind when you travel.

Image Quality

The Citizen is the standout here—it produces the sharpest edges and smoothest blacks. The DoveWriter (using its higher-quality single-pass ribbon rather than its multipass one) comes in second, followed by the MobileWriterPS. There's no smearing with these three; the ink bonds well to paper even after repeated folding. The ink-jets don't do as well, partly because liquid ink tends to wick along paper

continues

Portable Printers Compared

	Apple Portable StyleWriter	DeskWriter 310	DoveWriter 1 Portable	MobileWriter PS	Notebook Printer II
Company	Apple Computer	Hewlett-Packard	Dove Computer	Mannesmann Tally Corporation	Citizen America
Phone	408/996-1010	208/323-2551	919/763-7918	206/251-5524	310/453-0614
Toll-free phone	800/538-9696	800/752-0900	800/849-3297	800/843-1347	none
List price	\$439	\$379	\$399	\$999	\$399
Weight (printer plus cables and adapters, in pounds)	5.94 (4.5+1.44)	5.4 (4.3+1.1)	4.34 (2.9+1.44)	9.5 (8.3+1.2)	3.35 (2.6+0.75)
Size (in inches)/volume (in cubic inches)	12.2 × 8.7 × 1.9/202	11 × 5.75 × 2.5/173	12 × 8.5 × 1/102	11.4 × 8.7 × 2.3/228	11.7 × 4.1 × 2/96
Printer-to-Mac connection	parallel; serial converter included	LocalTalk (RS-422)	parallel; serial converter included	LocalTalk (RS-422); parallel	LocalTalk (RS-422); parallel
Built-in sheet feeder	none	none	none	80 sheets	5 sheets
Optional external sheet feeder	50 sheets, \$85	60 sheets, \$76-\$99	20 sheets, \$99	none	30 sheets, \$69
Carrying case	not sold by Apple	\$99 option	plastic case included	\$50 option	\$49 option
Printing method	ink jet	ink jet	thermal transfer	thermal transfer	thermal fusion
PostScript printing	no	no	no	yes	no
Color capability	none	3-color	none	none	4-color
Resolution (in dots per inch)	360	300	360	300	360
Text image quality	fair	poor to fair	fair	fair	good
Halftone image quality	fair	poor to fair	can't print halftones	fair	fair
Margins (left/right/ top/bottom, in inches)	0.31/0.18/0.1/0.58	0.13/0.4/0.28/0.4	0.43/0.05/0.18/0.71	0.23/0.08/0.06/0.14	0.08/0.4/0.16/0.54
Pages printed per minute	0.85	1.67	0.36	0.95	0.63
Pages per battery charge according to manufacturer	50	100	25-35	150	30-50
Black ribbon or ink unit cost/capacity	\$19/500 pages	\$21.95/500 pages	\$5.99/24 pages (see text)	\$75 for 5 ribbons/ 750 pages total	\$4.99/30-50 pages
Ink or ribbon cost per page	\$0.038	\$0.044	\$0.25 (see text)	\$0.10	\$0.10-\$0.17

fibers. Nevertheless, the Portable StyleWriter produces a fairly clean image, although its ink smears readily if it gets damp. HP's DeskWriter ink hardly smears at all, but tiny stray droplets produce a diffuse haze around the image, making it look coarse and splotchy. The DeskWriter wets the paper so thoroughly when printing large black or color regions that the paper buckles and pleats, more so than with the StyleWriter. In the printed areas, the feed tractor leaves tooth marks; the DeskWriter cannot use rubber rollers because of its wet ink.

All but the DoveWriter can print halftones. (Dove says it will add halftone printing with a future software upgrade.)

Printing Costs and Supplies

All the portables can use plain paper, with varying results, and all can produce transparencies for overhead projectors. The thermal printers produce the best results on smooth, well-calendered paper, but ordinary photocopy paper (usually half a cent per page) works satisfactorily. The ink-jets do best with short-fiber paper, although the StyleWriter is fairly tolerant of typical office paper for photocopying. The DeskWriter is very sensitive to paper type;

perhaps that's why Hewlett-Packard is the only printer vendor that also sells paper. Its short-fiber paper (CX Jet) goes for about 4 cents a page; you'll get the very best results from HP's LX Jet series glossy paper, but it sells for an eye-popping \$1.20 a sheet.

For ink-jets the ink costs about 4 cents a page, much less than the ink for thermal printers, which costs about 10 cents a page. The DoveWriter's ribbon costs depend on which type of ribbon it's using. Its higher-quality, single-pass ribbon costs 21 cents a page, but if you refill it, the cost drops to 10 cents a page; its multiple-pass ribbon, with lower print quality, costs 6 cents a page to run—3 cents if refilled.

Ink-jet cartridges can be refilled with third-party kits, lowering costs further. Although Apple and HP discourage their use, the better refills produce results as good as—and sometimes superior to—those of new cartridges. Both Apple and HP ink cartridges are readily available everywhere. The portable ink-jets share the same cartridges as their desktop siblings, with one exception: HP's high-capacity black DeskWriter cartridge works in the DeskWriter 310 but should be removed

before air travel because its ink bladder may leak with changing air pressure. Other DeskWriter cartridges use a sponge ink-feeder, which is unaffected by air pressure changes.

When you're traveling with a thermal printer, you should bring all the ribbons you think you'll need; few stores stock supplies, although Citizen's ribbons are the easiest to find.

Printing in Color

Two of the printers can produce color output—good enough for typical business charts and drawings, less satisfactory for photographs and halftones. The DeskWriter 310 prints in color as easily as it does in black, but much more slowly, about five to ten minutes a page. Its three-color (CMY—cyan, magenta, yellow) process produces a somewhat muddy black that's a composite of all three colors. A page with 20 percent ink coverage costs 31 cents for the ink.

The Citizen's four-color (CMYK) process makes for superior output, but it's even slower than the DeskWriter and much more expensive to run—about \$1.55 for a color page. The Citizen's un-



Apple Trees Bear Fruit For 50 Years

is done by spraying chemicals that damage about half of the trees blossoms. A chemical that is already registered by the Environmental Protection Agency for use on other crops

Apple trees will bear fruit after approximately four years and will continue to do so for about fifty years. Apples are now grown



twelve months out of the year in temperate latitudes of all continents. Until the early 1900's apples were not in season during the summer months. A breakthrough in the 1940's at Cornell University Agricultural College with controlled atmosphere storage extended the growing season year-round.

Left alone an apple tree will yield a large crop one year and few fruit the next. The apple tree voluntarily sheds some apples, but to truly counteract this effect orchardists thin their trees each spring. This thinning

can likely be a safe and effective spray. Several of the tested products have been found to effectively damage apple flowers so that they cannot be pollinated. This can be done



without harming bees, which are responsible for the pollination. Continued pg. 6

Focus On Color



Color is the key to picking fruit at its peak. Bright reds, yellows, greens, or oranges tell you that harvest time has arrived.



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usual ribbon consists of 8-inch color segments; it must constantly wind ahead to whatever color is needed. As a result, when you print pages that contain minimal color, whole sections of the color ribbon are never used. With considerable fussing, you can avoid this waste: print the bulk of the page with a black ribbon and switch to a color ribbon just before the printer reaches the section that requires color. Fundamentally, the Citizen is a black-and-white printer that can do the occasional nice-looking color job, whereas the DeskWriter can print less-attractive color, but effortlessly.

Sharing and Compatibility

None of these portable printers is likely to be shared by multiple Macs, but the MobileWriterPS is a full-fledged Local-Talk PostScript printer and is easily shared. The Citizen emulates Apple's desktop StyleWriter and can use its driver software, including Apple's GrayShare printer-sharing software. The Apple Portable StyleWriter and the DoveWriter are both parallel-interface printers and come with a GDT Softworks serial-to-parallel converter cable. Out of the box, neither can be shared, although GDT (604/291-9121, 800/663-6222) offers a \$90 software

upgrade, PowerPrint/SW, that enables sharing any printer or modem connected to a serial port.

All except the DeskWriter 310 can be easily used as a parallel-port DOS/Windows printer. (HP sells a separate DeskJet 310 for the DOS market.) Indeed, the Apple Portable StyleWriter is simply a relabeled Canon BJ10-sx printer, nearly identical to the BJ-10ex that has long been available in the DOS market. By bundling its Apple Font Pack, Apple makes its model a little more attractive than an equivalent package assembled from Canon and GDT products. For its print engine, the DoveWriter uses a Fujitsu Print Partner Portable.

The Portable StyleWriter and DoveWriter come with AC power adapters that work only with North American voltages; you'll need a second adapter or a transformer for worldwide use. The other printers come with universal adapters.

Should You Buy One?

If you don't already own a desktop printer, should you make one of these portables your only printer? Maybe. The two most popular low-end printers, Apple's StyleWriter and Hewlett-Packard's DeskWriter, come in both portable and desk-

top versions that are nearly equivalent, with identical image quality and ink-cartridge costs. Choosing a portable instead of a desktop version means making two compromises: the portables have smaller-capacity (and usually optional) paper feeders, and they cost about 20 percent more. In their favor, the portables are truly dual-use printers, suitable for an office and for travel. Even if you already have a desktop printer and rarely need to print on the road, you still might consider either the Citizen Notebook Printer II or the DeskWriter 310 for its color printing capability.

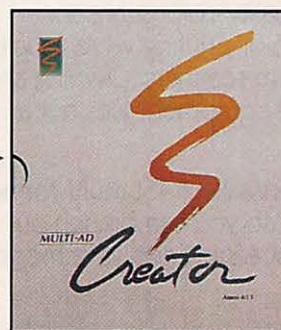
For PowerBook users who must frequently print when they travel, my top pick is the Citizen Notebook Printer II because it has the best image quality in a small, light package. But its running costs are high—especially for color—and it's no speed demon, although in most cases the efficiency of having a built-in sheet feeder cancels out its sluggish performance. Each of the five has its strong points; you can't go far wrong with any of them. **m**

CARY LU is a *Macworld* contributing editor who covers mobile- and remote-computing issues in this monthly column. His books include *The Apple Macintosh Book* (Microsoft Press, 1992).

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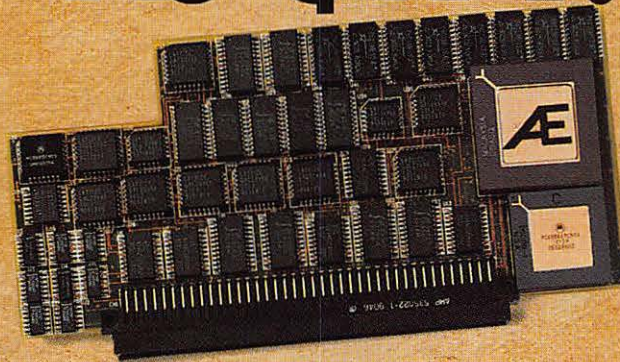
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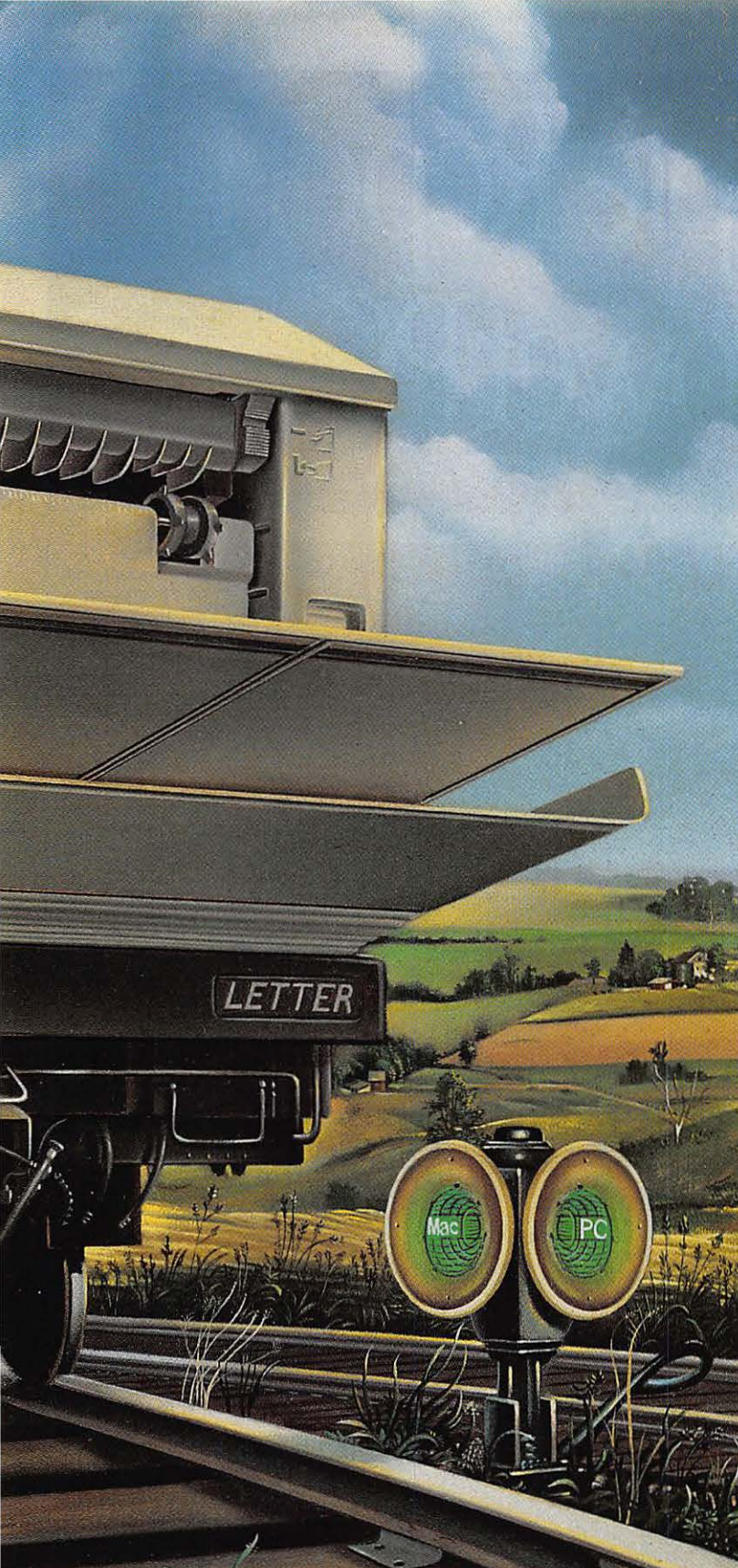
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Circle 167 on reader service card



i imagine a desktop printer designed to keep

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The Apple Report On PowerPC

Macintosh Compatibility and Upgrades

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By taking advantage of superior RISC technology, PowerPC requires half the number of logic transistors as Pentium. And fewer transistors make for smaller, cheaper, more energy-efficient chips.

Macintosh with PowerPC will use System 7, so it will run the thousands of applications currently available for the Mac.*

Upon the arrival of Macintosh with PowerPC, dozens of new programs designed to take advantage of its speed will also be available.

MS-DOS and Windows users will be able to run all their programs on the PowerPC platform from Apple.*

Macintosh with PowerPC has received rave reviews from developers who report workstation-level performance running applications designed just for the PowerPC processor.

Ready for PowerPC upgrade

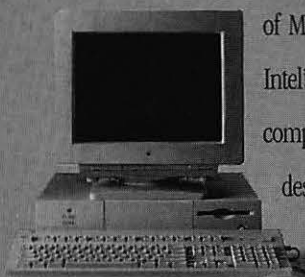
PowerPC™ is coming. The revolutionary RISC-based microprocessor family created jointly by Apple, IBM and Motorola. It will be the engine that Apple uses to generate the first truly radical improvements in mainstream computing systems. Improvements in power, price/performance and functionality. It will also serve as the heart of the next generation of Macintosh® personal computers, coming in the first half of 1994. In anticipation of its arrival, Apple will be running a series of information-rich reports keeping you abreast of all the exciting new advancements you can expect from Macintosh with PowerPC.

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of Motorola's 68040 or Intel's 80486 chips using comparable applications designed for PowerPC. Down the road, PowerPC will continue to fuel succeeding generations of Apple Macintosh computers, delivering equally impressive results.

On-ramp to the future.

So should you buy a Macintosh today or a Macintosh with PowerPC tomorrow? Well...yes. Apple is offering upgrade paths that will allow you to easily move from today's Macintosh computers to Macintosh with PowerPC. Ultimately, it will become the on-ramp to the future of personal computing. A future, you'll be pleased to discover, that also includes the security of compatibility with the past. Because Macintosh with PowerPC is still about giving you the most important power of all. The power to be your best.*

Apple 

Sit down and work on a Macintosh with PowerPC, and you'll quickly find that it's still a Macintosh. As easy to use as ever. As forgiving as ever. As human as ever.

Apple has already announced plans to ship upgrade products concurrently with the initial introduction of Macintosh with PowerPC systems.

Upgrades have been announced for the Macintosh Quadra® 610, 650, 660AV, 700, 800, 840AV, 900 and 950, the Macintosh Centris™ 610 and 650, the Macintosh IIfx and the popular Macintosh Performa® 600. More will follow.

Naturally, upgrade prices will vary by model. You can expect them to start at under \$1,000.

For more information about Macintosh with PowerPC, call 1-800-732-3131, ext.150, in the U.S. We'll send you a copy of our informative, free booklet, "PowerPC Technology: The Power Behind the Next Generation of Macintosh Systems." If you're reading this in Canada, call 1-800-665-2775, ext.910.

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The Test of Time

A decade of products that keep on ticking—or don't

YEP, THE MAC IS TEN YEARS old—as measured in people years. In dog years, that's 70. But in technology years, it's more like 700 years.

If you doubt my math, try to imagine the world of Macintosh a decade ago. *Macworld* editorials complained that “a fully loaded System folder can easily weigh in at 200K.” Programs called MacSpell, Multiplan, and Lode Runner roamed the earth. “The Love Boat” was still on the air.

Oh, the progress we've made! Oh, the richness of choice we have today! Oh, the money we've blown on programs we never use! This is no industry for the weak-kneed; of the 101 companies whose products were listed in an early Mac Connection ad, 84 are now out of business. (Surprise! Microsoft is still doing fine.)

What determines whether a product will survive? This month, I thought it might be instructive to have a look at a handful of products that have remained on the market into the Mac's second decade. And a few that didn't.

And how did I select the products? Was it a scientific lab evaluation? A strategic demographic overview? A careful representative survey?

Nah. I picked whatever I felt like.

FileMaker

Born: January 1985, by Forethought, at \$199.

Sold today by: Claris, as FileMaker Pro 2.1, at \$399.

History: Believe it or not, FileMaker started out as the Mac version of a DOS program by Leading Edge. But that far-seeing company scoffed at the notion of Macintosh software, choosing to bank instead on the hot new computer from IBM—a little number called the PCjr.

The four programmers, ex-Wang employees calling themselves Nashoba Systems, therefore struck a deal with a tiny publisher called Forethought. The program, FileMaker, was the 23rd Mac product brought to market. When Microsoft gobbled up Forethought in 1987, it made Nashoba a paltry offer for File-

Maker. (Microsoft obviously didn't want FileMaker to outshine its own powerhouse database program, the now-deceased Microsoft File. I tell ya—this industry is just full of farseeing executives.)

Nashoba reclaimed the program, sold it under the company's own name for a year, and finally (in 1988) succumbed to a lucrative offer from Claris. The program, then called FileMaker Four, was renamed FileMaker II, to the complete confusion of everybody everywhere.

Key to longevity: FileMaker had plenty of worthy competition in its early days: such forgotten classics as MacLion, PFS:File, and 1stBase. But FileMaker took full advantage of the Mac's graphic possibilities. Furthermore, FileMaker offered nonpermanence: you could change your mind about anything at any time. Contrast this

sonal computing; when Raymond Lau wrote this classic file-squeezer, he was 15 years old. Lau wrote the program for his own use, never suspecting that his little after-school experiment would become a lucrative data-highway juggernaut.

Within a year, StuffIt was the standard for Mac compression. Lau wanted time for side activities (such as going to MIT and having a life). He offered StuffIt to Software Ventures, whose leaders (adhering to the tradition of Failing to Know a Good Thing If It Bites You) turned it down. In 1989 productless Aladdin Systems saw the light and took this shareware-program-that-could commercial.

Key to longevity: At the time of StuffIt's introduction, the only Mac compression program was PackIt. Lau's program was faster, compressed tighter, and preserved the folder structure of the compressed files. On top of all this, the thing was shareware (and if you only wanted to *unstuff* files, it was free).

No doubt about it: if you want your program to become a standard, nothing beats (1) making it better than the competition and (2) giving it away.

Aldus PageMaker

Born: July 1985, by Aldus, at \$495.

Sold today by: Aldus, as PageMaker 5.0, at \$895.

Key to longevity: Oh, good Lord, we all know why PageMaker made it big. It

was the first page-layout program for the Mac, right? Early bird gets the worm.

Actually, nope. PageMaker was the *third* page-layout program (after MacPublisher and ReadySetGo). What made it the colossal, industry-changing success it is today was, as Aldus president Paul Brainerd puts it, “a three-legged stool: the hardware, good luck, and timing.”

The hardware, of course, was the LaserWriter. In yet another case of executive myopia, there was a movement inside



with programs like PFS:File, which, when you tried to change the layout of your information, warned that “you may lose some or all of your data.”

StuffIt

Born: August 1987, by Raymond Lau, at \$15.

Sold today by: Aladdin Systems, as StuffIt Deluxe 3.0, at \$120. (A shareware version is still priced at \$25.)

History: StuffIt's original programmer wasn't exactly a grizzled veteran of per-

Apple to kill the LaserWriter project. Who'd buy a printer for \$7000?

Therefore, the LaserWriter product manager needed PageMaker as much as vice versa. Brainerd worked frantically behind the scenes with Adobe and Apple, dreaming up the brand-new buzzword *desktop publishing*. In a national tour reminiscent of Bill and Al's campaign bus ride, the little company of 12 people trained dealers, educated the market, and gave interviews.

There are three incredible aspects of Aldus today: (1) desktop publishing is nearly a \$3 billion market; (2) Brainerd still runs Aldus; and (3) they still haven't tacked *Pro* onto PageMaker's name.

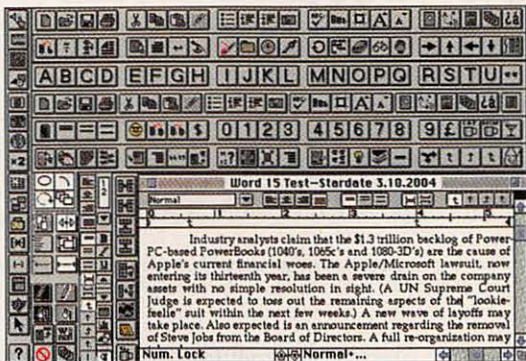
QuickDex

Born: June 1987, by Casady & Greene, at \$35.

Sold today by: Casady & Greene, as QuickDex II, at \$49.95.

History: Apple programmer Bill Atkinson demonstrated a little program called QuickFile (a tiny 9K address-book program) to programmers Robin Casady and Michael Greene. On the spot, they decided to create a desk accessory version.

Key to longevity: Unlike other phone-book programs, QuickDex doesn't have



Word 15 Assuming Microsoft Word continues to grow and thrive according to recent trends, here's an artist's rendition of Word 15.0, due to ship in the fall of 2004.

separate fields (blanks) for City, Street, Zip, and so on. Instead, you can type any info on each card, including your own notes ("met on plane; has terrible toupee" or whatever). Result: find a phone number in QuickDex—even with thousands of names typed in—instantaneously.

Still, QuickDex isn't nearly as full-featured as the more recent programs like TouchBase or Now Contact. So how come everybody still uses it?

My theory: You can't export free-form cards to a field-based program. Therefore, QuickDex will probably be

with us forever simply because it's too much trouble to switch.

Lotus Jazz

Born: August 1985, by Lotus, at \$595.

Died: June 1988

History: OK. You're Lotus. You come out with Lotus 1-2-3—boffo smash hit. You follow up with Symphony—instant triumph. So now you try a product for the Mac—integrated word processor, spreadsheet, graphics, database, telecom, all crammed, impressively, into 512K of memory.

You predict it'll be running on half of all the Macs in America.

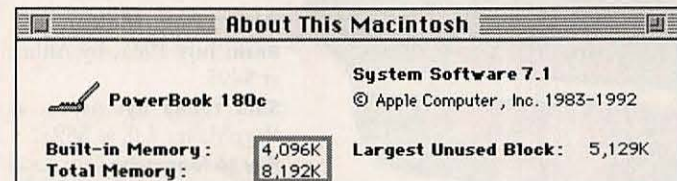
Key to its demise: You, too, can repeat the Jazz experience with these simple steps: (1) release the product a year late; (2) leave out the very features that made 1-2-3 a success (macros, power, and speed); (3) require exceptional Mac horsepower (512K and a second floppy disk drive); (4) make the memory situation so fragile that the word processor cops out after 17 pages and occasionally declines to carry out minor commands that require too much

continues

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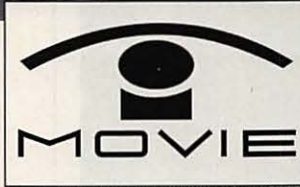
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memory to execute—like Save and Quit; (5) copy-protect the program so that dealers (let alone software pirates, whose significance as the unofficial first vanguard of software reviewers shouldn't be underestimated) can't easily demonstrate the thing. And then advertise like crazy.

Cauzin Softstrips

Born: October 1985, by Cauzin, at \$199.
Died: February 1987.

History: Softstrips were glorified bar codes that could be published in a magazine or photocopied. If you owned the Softstrip Reader, which looked something like a 16-inch-long fluorescent bulb in a hot-dog bun, you could scan these printed strips into your Mac to get a file of information. And lo, the icon for the file you'd just scanned would appear on the desktop.

In its ads, Cauzin waxed rhapsodic. "All your favorite books and magazines" would publish strips. Tiny shareware programs appeared right in the ads. In one ad, Cauzin even pitched Softstrips as a way to transfer data between PCs and Macs.

Key to its demise: Well, there was the chicken-and-the-egg syndrome, of course; nobody would buy a reader until there were enough published strips, but nobody would publish strips until . . . you get the

idea. Mainly, though, the Softstrips technology was slow and fussy. Each printed strip contained 3K of information, and took 2½ minutes to scan.

Hey, but it could still work, right? Sure. Your Word 5.1 upgrade comes in the mail printed on ordinary letter-size paper . . . 671 sheets of it. No problem. It'd only take 84 consecutive hours to scan.

TrueForm

Born: August 1989, by Spectrum Digital Systems, at \$495.

Died: 1991, as Adobe TrueForm.

History: For a nation obsessed with filling out forms, TrueForm seemed to be a fore-runner of things to come. It let you add on-screen blanks to the scanned image of a paper form. The result was you could bypass the painstaking task of re-creating a real-world form on the screen simply for the purpose of typing info into it. Adobe bought the program from Spectrum (nope, not John Sculley's Spectrum) in 1989, revamped it, and entered the marketplace later that year.

Key to its demise: It wasn't the software that failed, but the market. TrueForm and Claris's SmartForm (also defunct) got good reviews, were well promoted, and worked well—for all 17 people in the

forms-design industry. ("It turned out to be a smaller market than we expected," murmured a Claris spokesperson.)

The Upshot

Of course, there are plenty of other cautionary tales for creating Mac products. You might learn from the examples of Microsoft Write or QuarkStyle ("Stripped-down versions of best-sellers don't sell"); or of Wingz, Resolve, and Full Impact ("Nobody competes with Excel and comes out alive"); or Jasmine hard drives ("The customer is always right").

The lessons for creating products that do last, on the other hand, seem to be (1) make it good, fast, small, cheap, and not too ambitious; (2) make it easy to get into and hard to get out of; and (3) whatever you do, don't believe 'em when they tell you "it'll never work."

What'll Mac products be like ten years from now? This much I know: Word will have still more icon bars, version 1.0 of anything will still be buggy, and we'll still be dialing out of QuickDex. **m**

Contributing editor DAVID POGUE, author of *Macs for Dummies* (IDG Books Worldwide, 1993), was shipped in 1963. He's compatible with every Mac model and crashes only occasionally.

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7

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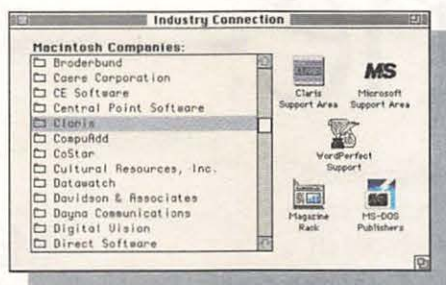
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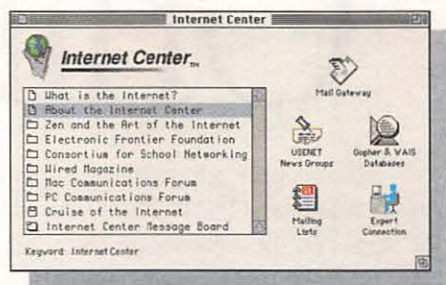
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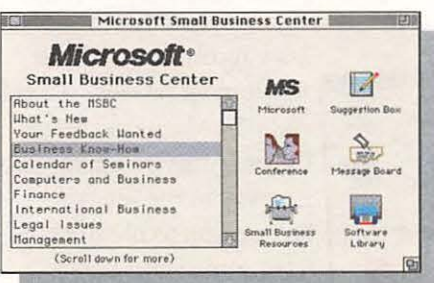
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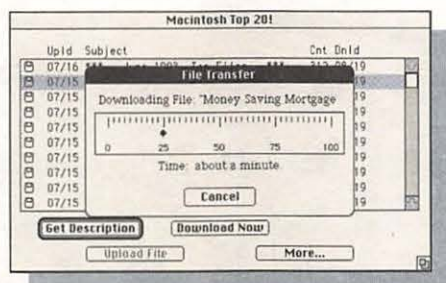
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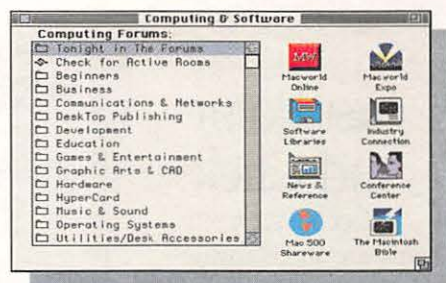
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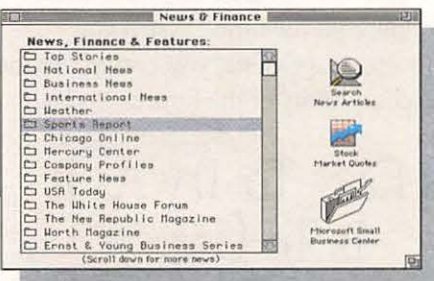
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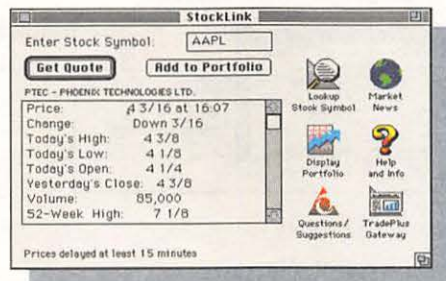
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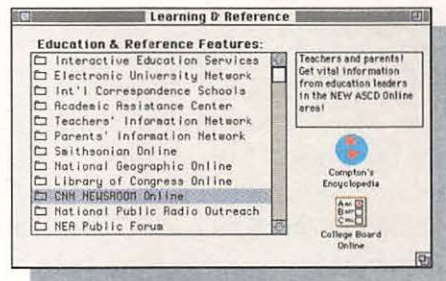
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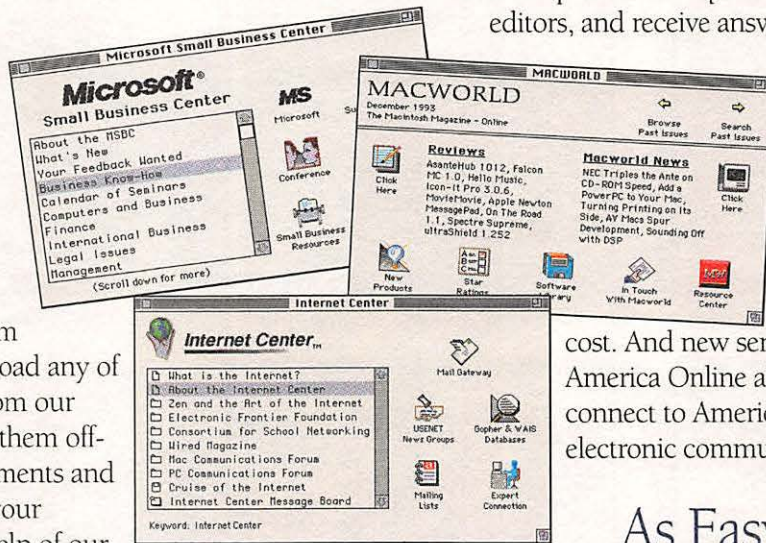
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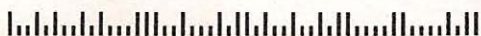
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Ten Years After

Did Macintosh change the world? Yes.

ALMOST EXACTLY TEN YEARS ago I first saw Macintosh, but I remember the day quite vividly. On assignment for *Rolling Stone*, I visited Bantley 3, development headquarters for the self-proclaimed pirates producing the much-bally-hooed machine. And I was blown away, not once but twice. First, of course, the source was that irresistible 14-inch-high box that said "Welcome to Macintosh": the coolest chunk of technology I'd ever come across.

The second mind-bender was the team that created Macintosh. Not only were they a tremendously smart and ambitious group of wizards, but also they were making some remarkable claims about their creation. Basically, their contention was that Macintosh was going to change the world. While under their spell in the corridors of Bantley 3, I went along with this, figuring that when I returned to the harsh winter canyons of New York City, I could reaffirm my cynicism, and reevaluate this nonsense with the proper measure of scorn.

This did not happen. To my surprise, I wound up accepting their claim: Macintosh was that rare product that was destined to make an impact, not only on the lives of its users, but on the culture itself. Ten years later, we can soberly assess its impact. Did Macintosh really change the world? Yes.

In Days of Old

To understand how this happened, we first must immerse ourselves in the mindset of pre-Macintosh life. Monsters ruled the desktop. Oh, the people who used those machines—the first generation of personal computers—believed they were on the absolute cutting edge of technology, and as far as things went those days, they were. After all, the Apple II and the IBM PC were delivering what most people in the information industries had only recently considered preposterous—an entire computer on a desktop, inexpensive enough for one person to afford, and equipped with tools that could aid that

person in performing his or her work. Yet those machines, despite their marvelous powers, were in a sense failures. Despite their claim to being "personal" computers, they presented an alien physiognomy to the poor fish who had to use them. Between the user and his or her information was a profound barrier.

This barrier came in the form of the interface presented to the person working the computer. These had come a long way from the early, batch-processed days of computing, when you communicated to the machine through punch cards and waited hours or even days for a response. But though the interaction was in real time, the forbidding spirit of batch processing persisted. The operating systems of these computers relied on esoteric

You never really got your hands on things. As a result, there was a gulf between the human beings tentatively tapping on keyboards and the piles of ones and zeros that by some black process could be transferred into meaningful sentences, charts, and pictures.

For years, some very bright people had been thinking of ways to bridge this gap. Maybe you can recognize some of the names: Vannevar Bush, Ivan Sutherland, Douglas Engelbart, and Alan Kay. The last, when he joined a team of world-class computer-science ninjas at Xerox Corporation's Palo Alto Research Center (PARC), actually implemented a system that allowed people deeper access to information. But Xerox couldn't figure out how to get it into the world. Then,

in November 1979, eight engineers and executives from Apple Computer mooseyed over to PARC to see what that stuff was all about. It turned out to be a heist (albeit a legal one) bigger than the Brink's job. The Apple-oids left PARC with the future in their heads.

Apple itself had an abortive first effort at implementing these ideas: the overpriced and overstuffed Lisa. But the company performed some serious innovation with Lisa, and when those ideas migrated to a small, impassioned group of engineers



working on something called Macintosh, everything changed. The Mac team, assembled at first by polymath Jef Raskin and ultimately led by an almost comically messianic Steve Jobs, was driven not only to craft a computer for "the people" (at least the kind of people they hung out with—spirited, hip, and aesthetically aware) but also to make it inexpensive enough so it would hit the marketplace with the impact of the post-Jurassic asteroid that made the dinosaurs go bye-bye.

In order to get anything done on these machines, you had to master the codes and invoke them, quite precisely, at the proper times. Once you learned them, of course, you could motor along quite nicely and get some useful things done. But your every action was a reinforcement of the idea that you were in one place and your information was somewhere else. You were never in control.

continues

Talk about reaching for the stars! This was a relatively tiny band of engineers (never more than ten in the group), a kind of portable Manhattan Project in blue jeans. Yet, by refining and reworking the ideas of Lisa, which in turn were transmogrified visions from PARC and its predecessors, we got Macintosh, which embodied an approach to manipulating information drastically different from the loathsome protocols to which people had become accustomed.

Vive La Différence

What was the difference? Instead of relying on the middleman of commands to get your information—dispatching some digital homunculus to the back room to fetch your spreadsheet from the registers—you did it. Digitally speaking, you got your hands dirty. You looked on the screen, and there was the folder you'd put the file into. You dipped your hand into the informationscape and opened the folder, then did it again and got the file. It wasn't a rough sketch of the file, either—it was pretty much what the file would be when you printed it out. In fact, in many cases, you didn't need to print it out. Working solely in the medium of electrons, you could finally do your work

with the same confidence you had when you worked with paper.

In a sense, Macintosh was a virtual reality machine. An artificial world existed inside every box. It was a consistent one, and every detail was thought out very carefully, down to the pinstripes on the title bars and the number of times the reverse type flashed when you selected something on a drop-down menu. (Sometimes these solutions were arrived at after furious debates.) But what you saw was something with elements of an office—folders, trash can, printer, tools, and documents. These were metaphors, but after working with Macintosh for a while, something very odd happened. The metaphor became reality. Those icons representing documents called up real documents. When you tossed something in the Trash Can, it was really thrown out.

This metaphorical realm—some people call it cyberspace—was actually a place you could work in (and play in). We all spend lots of time there now, but for many of us Macintosh was our first full frontal exposure to what William Gibson calls "a consensual hallucination." Once consent was granted, we could get some work done.

Because this world was so versatile,

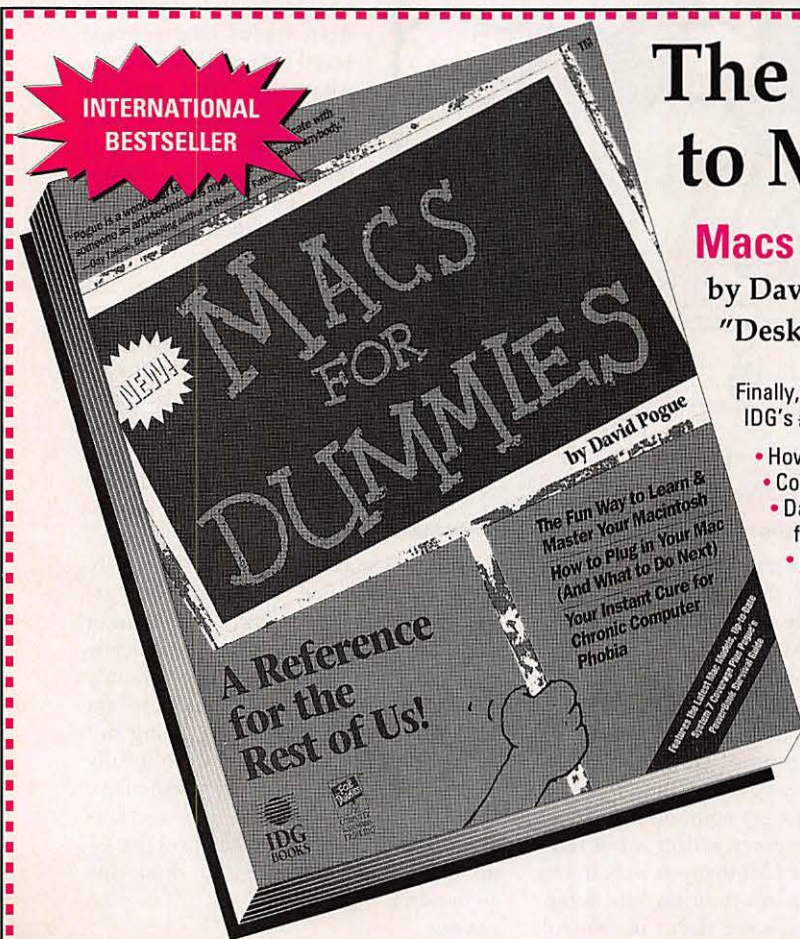
Macintosh also broke the barrier between text and graphics. Since Mac used bitmapping, an innovation employed at Xerox, everything on a Mac screen was literally a graphic element. While this exacted a price in memory and cost, it also allowed for WYSIWYG (what you see is what you get). And prodded by MacPaint, Bill Atkinson's charming screen-art program, every new Macintosh owner quickly learned that this machine made it easy to be graphically artistic. ("Until now the world of art has been a sacred club, like fine china," Atkinson told me. "Now it's for daily use.")

These days, of course, other computers besides Macintosh use these techniques. But the ideas exploded into the mainstream with Macintosh. It's obvious to any executive who sees business reports, any scientist who sits through lectures illustrated with overheads, and any college professor who receives term papers, that there has been a revolution in the way people visually produce information. Macintosh made it happen.

Macintosh Forever

The permanent legacy of Mac, though, will be the idea behind it—that information

continues



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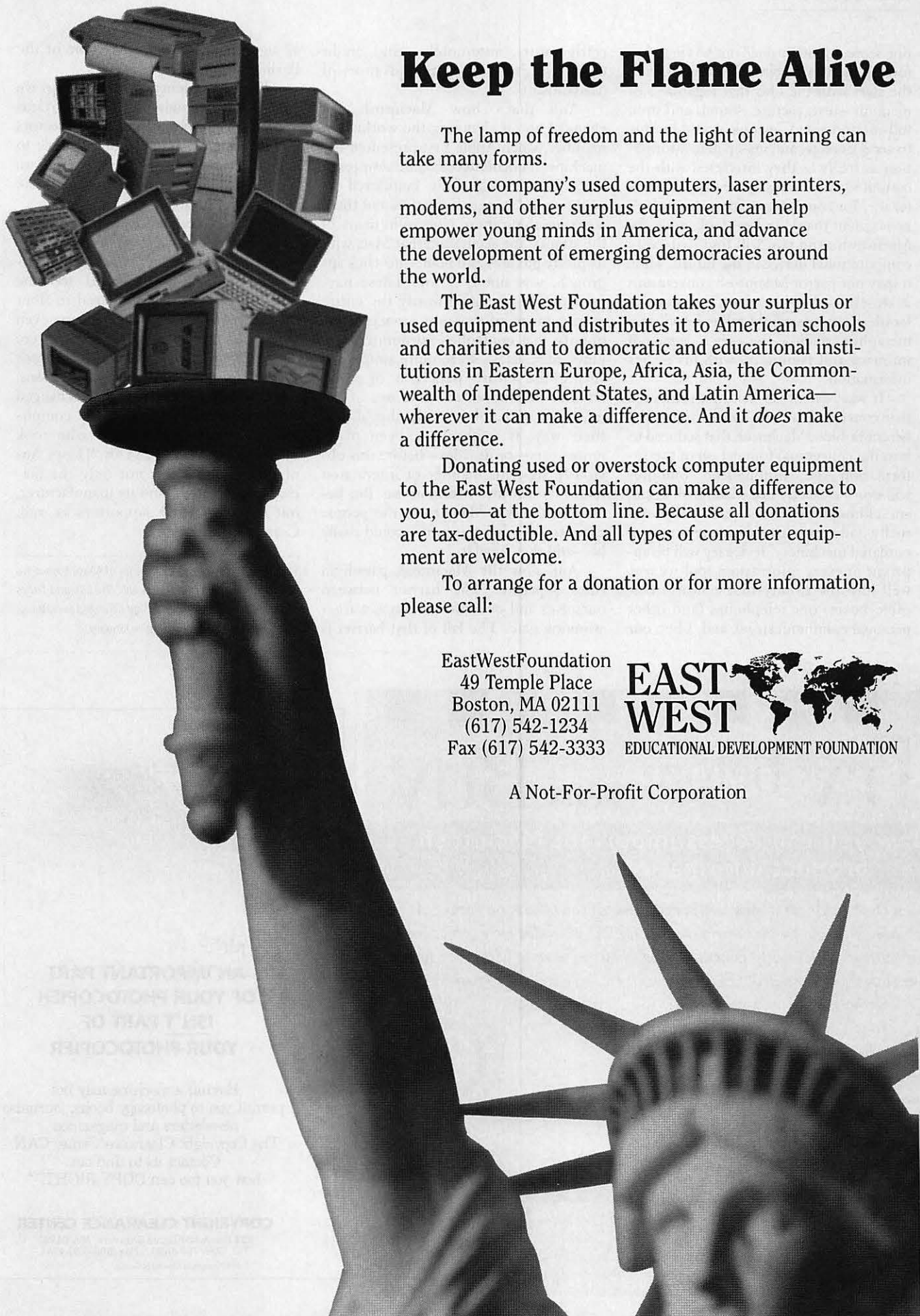
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tion stored digitally need not be viewed as foreign matter. Macintosh was built from the start with the idea that regardless of medium—text, picture, sound, and even full-motion video—people would be able to access, create, and manipulate information as freely as they interacted with the natural world. This is, quite simply, a better way for computers to operate, and it's no accident that Windows looks a lot like Macintosh. And you will find that every computational device in the future, while it may not parrot Macintosh conventions as closely as Windows does, uses some of its ideas, and certainly relies heavily on metaphor to allow the user a degree of intimacy and familiarity with his or her information.

It was Macintosh that first presented that concept to a mass audience in a coherent fashion, Macintosh that seduced us into the conceptual foundation of the Information Age. Although no computer will ever be exactly like Macintosh again, and although Macintosh itself will eventually fade into the geriatric ward of outdated machinery, its legacy will be apparent in every information tool we use, well into the twenty-first century. Our cable boxes, our telephones (and other personal communicators), and, I bet, our

refrigerators, automobiles, and credit cards, will build upon the advances of Macintosh.

And that's how Macintosh has changed and is changing the world. Remember, when Apple first presented the machine, it encountered *tremendous* resistance. Critics rightfully lambasted its memory and storage limitation, but there was something more visceral in many of the attacks: the accusation that Mac, with its pretty pictures and point-and-click approach, was simply a toy. These naysayers—who included nearly the entire management information services community that controlled corporate computer purchases—were quite simply resisting the entire paradigm of using familiar metaphors to make use of the information revolution. If they'd had their way, it might have been many more years—or decades—before this obviously superior manner of interaction found its way into common use. But because there was Macintosh, the people came to see what the future could really be—and they liked it.

And now the Macintosh paradigm rules supreme. The barrier between ourselves and our information is a free-swinging gate. The fall of that barrier is

as significant a collapse as that of the Berlin Wall.

There are plenty of other things we will remember about Macintosh: its status as a fetish, the lionization of its creators and marketers, Apple's futile struggle to keep its ideas closely held. . . . (And there are things we will gladly forget, like the Macintosh Portable.)

But as we celebrate its anniversary, let's remember this: it wasn't solely the Macintosh technology that made the system so compelling. It was us, too: the people who used it. We dared to flout convention by buying the machine even when the stuffy pundits of high tech were dismissing it as a toy. We let Macintosh work its magic on our own perceptions. The Macintosh computer indeed changed the world—but only with the compliance of millions of people who took mouse in hand. So when I say "Happy Anniversary," I address not only the machine, its creators, and its manufacturer, but its owners and supporters as well. Congratulations! **m**

STEVEN LEVY explores the history of Macintosh in his forthcoming book, *Insanely Great: The Life and Times of Macintosh, the Computer That Changed Everything*. It will be published by Viking in January.

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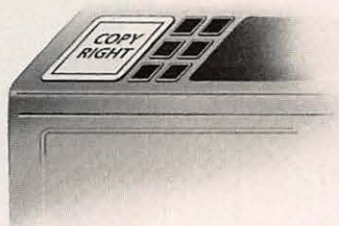
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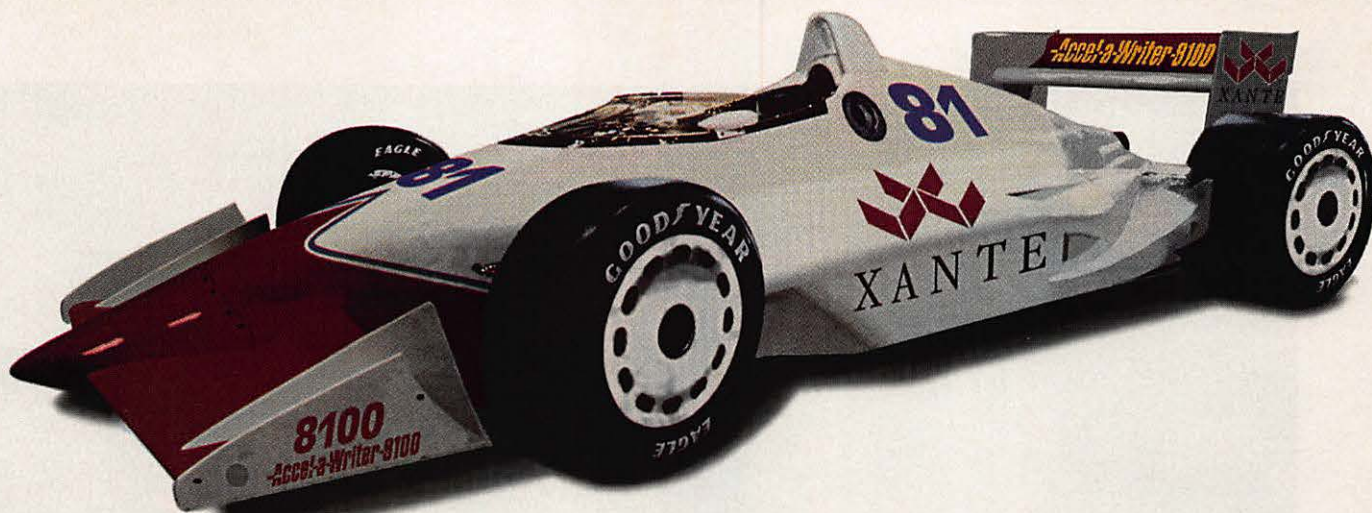
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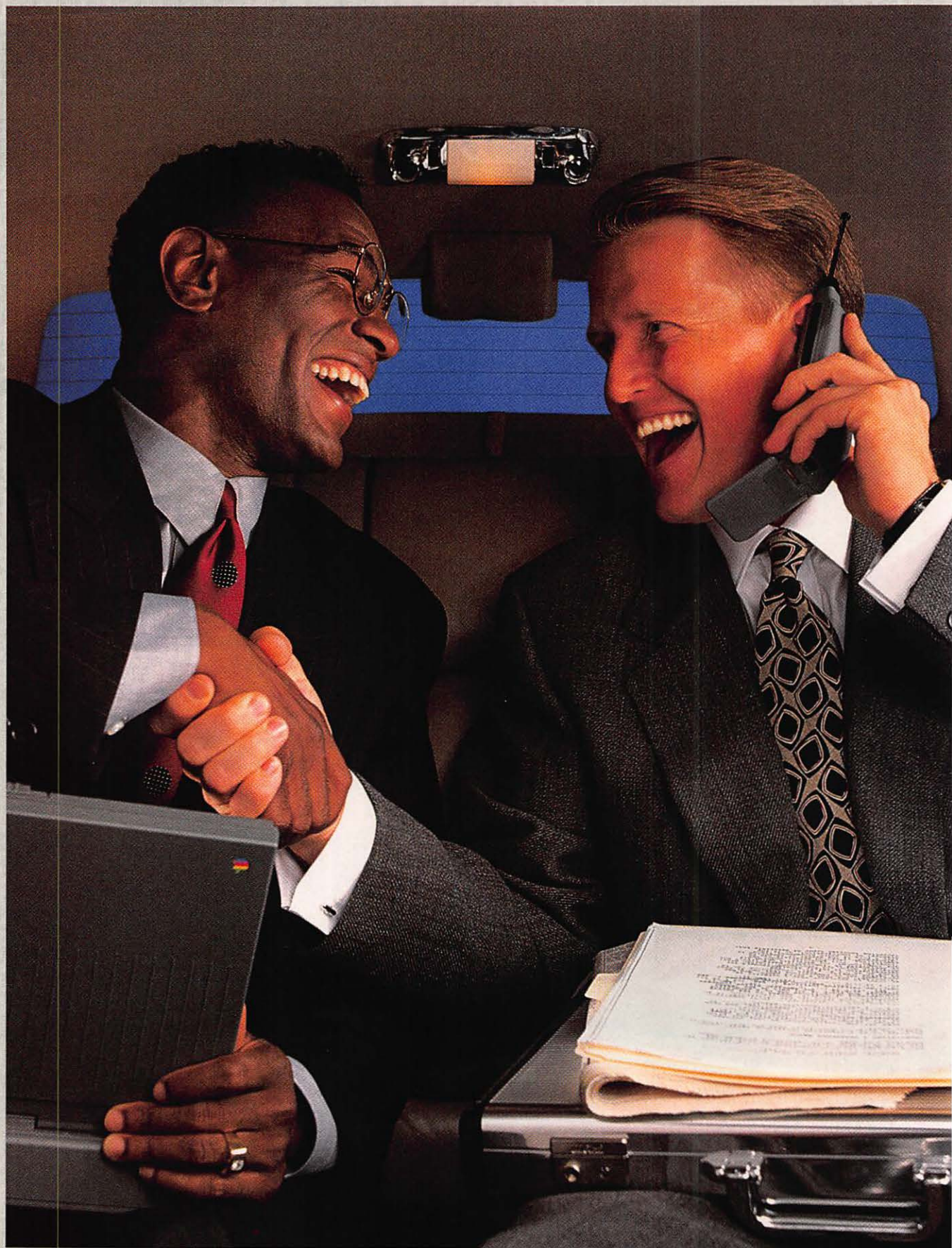
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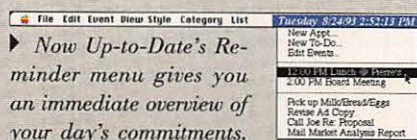
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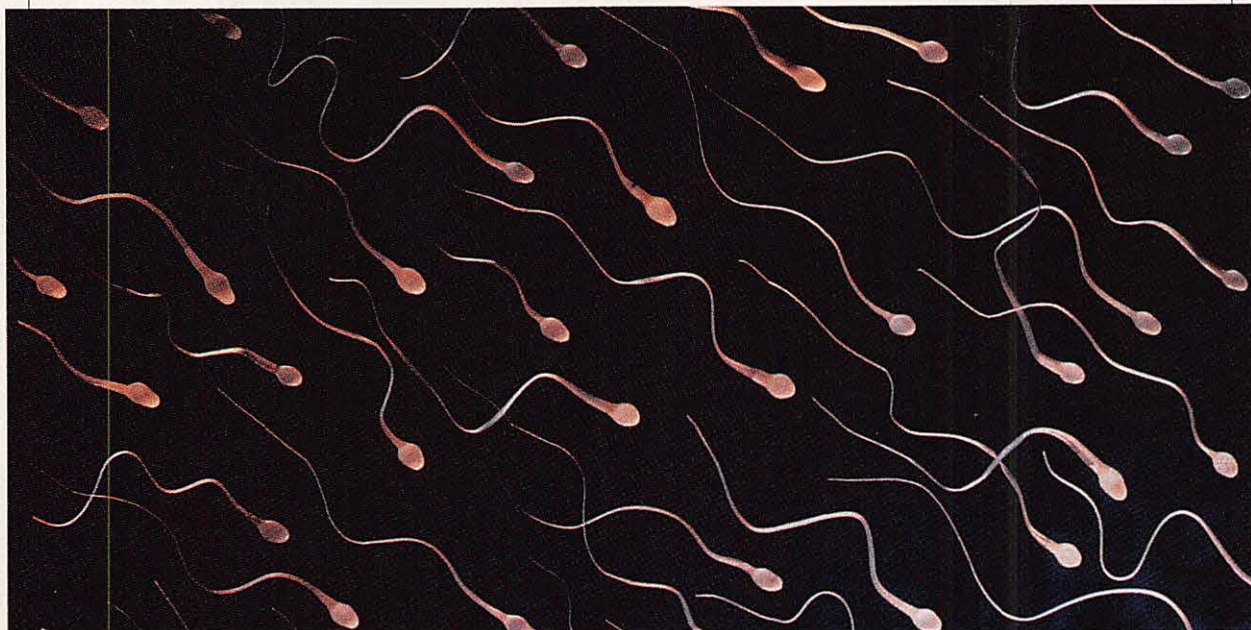


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Saints and Sinners Revisited

The third annual roundup of nice—and naughty—companies

YES, IT'S TIME AGAIN TO REVIEW the Macintosh scene and evaluate industry saints and sinners. This year, as usual, consumers coped with uneven treatment in the areas of quality, service, and support. Which companies are basking in the glow of good deeds done and have earned a halo? Which have shown the more devilish bent illustrated by horns? Keep reading to find out. (Listings are in alphabetical order.)

 Adobe Systems, Kensington Microwave, and Microsoft Corporation all earned halos with their exemplary records of being responsive to the reader complaints that *Macworld* forwards. (By the way, when I praise companies for being responsive to complaints, that doesn't necessarily mean that the customers are always satisfied with the outcome. It does mean, though, that each company has been thoughtful, communicative, and polite in addressing customers' concerns.)


 Information service America Online rates horns for a billing problem that began last August and still existed in November. Some Macintosh users find themselves being charged for time spent in free areas. Moreover, 9600-bps access still isn't available to the masses. (One nice move—AOL promises there will be no extra charge for 9600-bps service, once it arrives.)



  It's been a year of great change for Apple and its customers, as Michael Spindler took charge, the company downsized, John Sculley left, and Macintosh model after Macintosh model was rolled out the door. As usual, Apple's been both a saint and a sinner. Its heavenly practices include continuing to drop prices on its computers, making them truly competitive with Intel-based machines. Apple also introduced the first desktop computer (the Color Classic) that meets the Environ-

mental Protection Agency's Green Star guidelines for reduced power consumption (the sleep mode cuts electricity use by half when the machine is not in use). And the Earth's ozone layer is sure to be grateful that Apple dropped its worldwide chlorofluorocarbon emissions from manufacturing to zero in 1993 from a peak of 270,000 pounds in 1990.

But Apple again showed its devilish side with inaccurate or inadequate product specs. Contrary to the *Apple Catalog* description and other product literature, the Quadra 610 8/160 does not include a math coprocessor. And contrary to the box packaging and reassurances by some


ing its customers outside California that their cards were now worthless. Finally, the company's track record for resolved customer complaints is improving but not yet sterling. In some cases Apple requires people to sign away their legal rights in order to get a settlement—and not necessarily a good one.

 Mail-order companies APS, MacDepot (now part of MacMall), MacWarehouse, and MacZone are saints in my book for responding promptly to each reader complaint I bring to their attention.

  DayStar Digital earns a halo for a low-cost upgrade promotion and horns for somewhat spotty execution of the offer. In 1992, the company offered a \$99 upgrade to a 33MHz 040 board to Mac owners who bought by October 31 a 50MHz 030 PowerCache accelerator that included a math coprocessor. More than a year later, the promised 040 upgrade had not materialized according to three customers who apparently fell through the cracks and were getting restive about the wait. In its defense, DayStar points out that hundreds of customers have upgraded successfully to the 040 board.



salespeople, the Performa 475 does not use a standard 040 chip but the 68LC040 instead. So it doesn't include a math coprocessor either (but at least it doesn't actually claim to), much to the disappointment of a few *Macworld* readers. Hello gray scale—it turns out the Quadra 840AV can't capture color QuickTime video when used with monitors larger than 16 inches—but dealers don't know that. Apple also discontinued its credit card program for purchasing Apple products last August—without directly inform-

 Game company Graphic Simulations Corporation took a lot of time to produce its second flight simulator, F/A-18 Hornet. But in contrast to some others in the industry, GSC reportedly kept its customers up-to-date on progress with the game. The company also actively recruited suggestions for improving the game and then incorporated many of those suggestions. Finally, the company maintains active and responsive online technical support. So Graphic

continues


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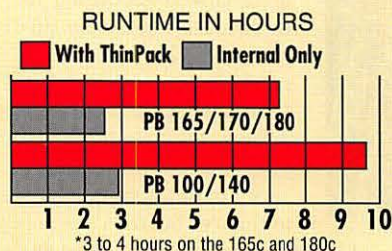


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Simulations earned its halo for maintaining communications with customers and providing consistent technical support.

 Bugs are an unfortunate fact of life for any computer developer but some bugs are more painful than others. Microtek Lab landed on the sinners list this year because of problems with the ScanMaker II and the scanner's accompanying Photoshop plug-in. The ScanMaker II comes set with SCSI ID 6; version 2.03 of Microtek's Photoshop plug-in could delete the contents of a hard drive if the drive also used SCSI ID 6. Microtek tried to fix the problem with version 2.04 of its software. But 2.04 sometimes writes to a removable disk drive as though it were a scanner, erasing the disk. Ouch. Version 2.05 fixes the problem, according to Microtek.

 Mirror wins both horns and halo. A halo because it bundles a full version of Adobe Photoshop with its scanners, not a limited version like some other companies. Horns because it ran two inaccurate advertisements early last year that offered a lifetime warranty on its products. (At the time Mirror believed it could work out a new warranty agreement with its suppliers, which turned out to be incorrect.)


 Pastel Development Corporation may have a winner in its Day-Maker 3.0, but some disgruntled customers report that during the many months Pastel was working on version 3.0, the company was not responding to phone calls. One example is reader Randy Anderson. He prepaid for the upgrade to 3.0 in October 1992 and didn't get a response to his letters or phone calls about his purchase between April and late October, when 3.0 finally landed in his mailbox.


 Quark's policy that registered customers must pay the full fee for replacement software and manuals should the software be lost in, for example, a hurricane, doesn't really rate additional comment—just a pair of horns.


 Shiva Corporation gets dinged for its failure to be responsive online in its own forums on CompuServe and America Online for several months in 1993. The good news is that the company hired an online support person who made his debut in November, which should salvage the situation.


 Last April a Georgia-based company called SofTeam promised to offer great customer support for its dynamic-model spreadsheet called Flippant, in the form of bug notification, free bug-fixes, and a monthly newsletter. At the same time, the company was raising capital by selling

Flippant while the product was still under development. SofTeam gets both a halo and horns; the halo is for being more honest than many companies in admitting its software isn't really there yet. Raising capital by selling software still under development is novel but not particularly customer-friendly, which is why the company—which I haven't been able to locate—also deserves a set of horns.

 State of the Art alienated some customers this year after it took over the Accountant Inc. line of products and declined to continue supporting customers who did not upgrade to Accountant version 3.5.2. That's a business decision the company felt justified in making. But a letter mailed out in July really ticked off some folks. State of the Art explained that it made the decision not to support older versions of the program "at the potential cost of customer goodwill, corporate reputation, and future revenue," and later states "there will not be any further individual responses concerning the issues addressed in this letter." State of the Art earns its horns not for what it considered a necessary business decision but for its not-very-businesslike communication of that decision to its customers.

 Virtus Corporation responded admirably to the approximately 700 customers who ordered copies of Virtual Sketch Pad for \$60. Because Virtual Sketch Pad became a different product (Virtus VR), the company mailed its customers Virtus WalkThrough, a \$195 program, for the same price. A fabulous gesture.

 Jim Warren, a columnist for computer tabloid *MicroTimes*, won his halo by helping California residents win electronic access to much of the information generated by the California legislature. Last spring Assembly member Debra Bowen introduced AB 1624, which was stymied by lack of support and legislators' concerns about cost. Warren rallied support for the bill and showed how low-cost access could be provided via Internet—both crucial to the bill's success. Online access becomes available in early January 1994.

Did I miss a saint or a sinner? Help keep me up-to-date for next year's roundup by sending me praise as well as complaints involving Mac developers and companies. In the meantime, happy computing, and thanks to the many companies that provide good service every day. 

Send nominees for sainthood to *Service Heroes*, Macworld, 501 Second St., San Francisco, CA 94107, or via AppleLink (Macworld1) or America Online (Branscum). Conversely, drop *Conspicuous Consumer* a line if a company is ignoring you.

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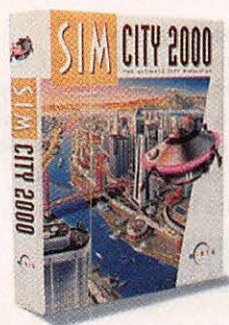
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Editors' Choice

THE BEST PRODUCTS FEATURED IN MACWORLD

Edited by Susan Grant-Marsh

Macworld Editors' Choice is a complete listing of the hardware and software products selected as the best of their type in *Macworld's* comparative articles through the past year. A ♦ next to a product indicates that we chose more than one product in that category.

Hardware

MONITORS

BLACK-AND-WHITE MONITORS, May 93

Portrait monitor: 15-Inch Gray Scale Portrait Display; Mirror Technologies, 612/633-4450; \$399, with video-display board \$549.

Two-page monitor: ♦ L-View MultiMode; Sigma Designs, 510/770-0100; \$1099, with video-display board \$1398. ♦ MD 202 Two Page Display; Mobius Technologies, 510/654-0556; \$699, with video-display board \$798.

COLOR MONITORS, Oct 93

16- and 17-inch: ♦ ErgoView 17; Sigma Designs, 510/770-0100; \$1349.

♦ MultiSync 5FG; NEC Technologies, 708/860-9500; \$1355 (NEC's estimated dealer price).

GRAY-SCALE MONITORS, May 93

Portrait monitor: Pivot Display; Radius, 408/434-1010; \$849, with video-display board \$1148.

Two-page monitor: MultiMode 120, SilverView Pro; Sigma Designs, 510/770-0100; \$1099, with video-display board \$1299.

SMALL COLOR MONITORS, Jan 94

14-inch display: ♦ Sony CPD 1430; Sony Corp. of America, 800/222-7669; \$779.95. ♦ Nanao FlexScan F340i•W; Nanao USA, 800/800-5202; \$899.

15-inch display: NEC MultiSync 4FG; NEC Technologies, 708/860-9500; estimated street price \$755.

NETWORK HARDWARE

HARDWARE ROUTERS, Jul 93

Under \$1500: EtherRoute; Compatible Systems, 303/444-9532; base model \$1495 (no TCP/IP support).

Between \$1500 and \$3500: InterRoute/5; Farallon Computing, 510/814-5000; \$3299 to \$3499.

HIGH-SPEED FAX MODEMS, Oct 93

Teleport Gold and Silver with Global Fax; Global Village Communication, 415/390-8200; Gold \$499, Silver \$429.

POWERBOOK TOOLS

DUO DOCKING CONNECTORS, Feb 93

PowerLink DeskNet; E-Machines, 503/646-6699; \$699.

EXTERNAL HARD DRIVES, Feb 93

♦ Companion 120; APS Technologies, 800/874-1428; \$599. ♦ PocketDrive 120MB; La Cie, 503/520-9000; \$699.

INTERNAL FAX MODEMS, Feb 93

♦ PowerModem series; PSI, 408/559-8544; \$195 to \$495. ♦ PowerPort series; Global Village Communication, 415/390-8200; \$229 to \$499.

PRINTERS

COLOR PRINTERS, May 93

Dye-sublimation: ♦ ColorStream/DS; Mitsubishi International, 408/980-1100; \$9950. ♦ Phaser IISD Color Printer; Tektronix, 503/682-7377; \$9995.

Thermal-wax: ♦ ColorScript 210; QMS, 205/633-4300; \$4995. ♦ Personal ColorPoint PSE; Seiko Instruments, 408/922-5800; \$2999.

Low-end liquid-ink: HP DeskWriter 550C; Hewlett-Packard, 800/752-0900; \$1099.

Midrange liquid-ink: HP PaintJet XL300; Hewlett-Packard, 800/752-0900; \$3495.

Solid-ink: Phaser III PXI Color Printer; Tektronix, 503/685-3585; \$9995.

PERSONAL PRINTERS, Sep 93

Ink-jet: StyleWriter II; Apple Computer, 408/996-1010; \$359.

PostScript laser: TI microLaser Series; Texas Instruments, 512/250-6679; \$1199 to \$1599.

QuickDraw laser: LaserWriter Select 300; Apple Computer, 408/996-1010; \$839.

WORKGROUP PRINTERS, Feb 94

High-speed: Hewlett-Packard 4Si MX; Hewlett-Packard, 800/752-0900; \$5499.

Best buy: ♦ Apple LaserWriter Pro 630; Apple Computer, 408/996-1010; \$2529. ♦ Hewlett-Packard LaserJet 4M; Hewlett-Packard, 800/752-0900; \$2329.

SCANNERS

LOW-COST COLOR SCANNERS, Nov 93

\$1300 to \$1600: ♦ La Cie Silverscanner II; La Cie, 503/520-9000; \$1599. ♦ Hewlett-Packard ScanJet IIc; Hewlett-Packard, 800/752-0900; \$1599.

Under \$1300: Mirror 800 Plus Color Scanner; Mirror Technologies, 612/633-4550; \$1299.

OCR, Nov 93

OmniPage Professional; Caere Corp., 408/395-7000; \$995.

SYSTEMS/STORAGE

DOUBLE-SPEED CD-ROM DRIVES, Jul 93

Sheer speed: Pioneer DRM-604X; Pioneer, 408/988-1702; \$1795.

Overall value: AppleCD 300; Apple Computer, 408/996-1010; \$599.

Budget choice: NEC MultiSpin 38; NEC Technologies, 708/860-9500; \$465.

HIGH-SPEED HARD DRIVES, Aug 93

2.7GB drives: ♦ Nova XL 2700; Microtech International, 203/468-6223; \$2999. ♦ Vista 3.5GB; Relax Technology, 510/471-6112; \$3499.

SCSI-2 adapter: QuickSCSI; PLI, 800/288-8754; \$499.

MACINTOSH UPGRADES, Jun 93

Classic accelerator (40MHz): TransWarp Classic; Applied Engineering, 214/241-6060; \$798 (with FPU).

SE accelerator (50MHz): Gemini Integra; Total Systems, 503/345-7395; \$1089 (with FPU).

SE accelerator (25MHz): Quik30; Novy Systems, 904/427-2358; \$449 (without FPU).

SE/30 accelerator (50MHz or 33MHz): Universal PowerCache; DayStar Digital, 404/967-2077; 50MHz \$999 (with FPU), 33MHz \$449 (without FPU).

LC and LC II upgrades: Macintosh LC III Logic Board Upgrade; Apple Computer, 408/996-1010; \$599.

Mac II accelerators: ♦ Radius Rocket 25i, Radius Rocket 33; Radius, 408/434-1010; 25i \$1199, 33 \$2499. ♦ Universal PowerCache series; DayStar Digital, 404/967-2077; \$449 to \$999.

Ilfx SCSI accelerator: QuickSCSI; PLI, 800/288-8754; \$499.

Quadra static-RAM cache card: FastCache Quadra; DayStar Digital, 404/967-2077; \$299 for Quadra 700 and 900, \$449 for Quadra 800 and 950.

MIDRANGE HARD DRIVES, Mar 93

Low-capacity drive: La Cie Cirrus 240; La Cie, 503/520-9000; \$769.

Notable technology: DiamondDrive 510; Mass Microsystems, 408/522-1200; \$2089.

Bargain: APS Fujitsu 520; APS Technologies, 800/874-1428; \$1149.

All-around quality: hammer 525FMF; FWB, 415/474-8055; \$2799.

OPTICAL DRIVES, Dec 93

3½-inch: ♦ Epson OMD 5010; ClubMac, 800/258-2622; continues

Editors' Choice

\$959. ♦ 128 MO; APS Technologies, 800/874-1428; \$899.
5 1/4-inch: ♦ Sharp JY-750; ClubMac, 800/258-2622; \$1829. ♦ Infinity MaxOptical 11m; PLI, 800/288-8754; \$4113.

VIDEO/DISPLAY

24-BIT COLOR GRAPHICS BOARD, Feb 93

♦ Spectrum/24 PDQ Plus; SuperMac Technology, 408/541-6100; \$1999. ♦ Thunder/24; SuperMac Technology, 408/541-6100; \$2999.

COLOR LCD PROJECTION, Jan 93

Display panel: MediaPro; nView Corp., 804/873-1354; \$7995.

Low-end panel: TFT Rainbow HD Model 700; Chisolm, 408/559-1111; \$5295.

Complete LCD projector: System 6000; In Focus Systems, 503/692-4968; \$8495.

VIDEO-CAPTURE BOARD, Jan 93

VideoSpigot; SuperMac Technology, 408/541-6100; \$449 to \$1399, depending on bundling options.

Software

ACCOUNTING/FINANCE

GROWING A SMALL BUSINESS, Nov 93

Small-business system: M.Y.O.B.; Teleware, 201/586-2200; \$199.

Home office/personal finance: MacMoney; Survivor Software, 310/410-9527; \$119.95.

PERSONAL FINANCE, Jun 93

♦ CheckWriter 4.0; Aatrix Software, 701/746-6801; \$79.

♦ Andrew Tobias' Managing Your Money 5.0; MECA Software, 203/256-5000; \$79.95.

BUSINESS TOOLS

STATISTICS, Oct 93

Exploratory data analysis: DataDesk 4.1; Data Description, 607/257-1000; \$595.

Comprehensive package: SYSTAT 5.2.1; SYSTAT, 708/864-5670; \$895.

COMMUNICATIONS/NETWORKS

HIGH-SPEED FAX MODEM SOFTWARE, Oct 93

Faxstf; Telefocus, 816/886-9800; \$79.

NETWARE CONNECTIVITY, Sep 93

NetWare for Macintosh; Novell, 801/429-7000; \$495 for 5-user license to \$2295 for 200-user license.

NETWORK DIAGNOSTICS, Feb 93

Ethernet: EtherPeek; AG Group, 510/937-7900; \$795.

LocalTalk: LocalPeek; AG Group, 510/937-7900; \$495.

NETWORK MANAGEMENT, Feb 93

Network SuperVisor; CSG Technologies, 412/471-7170; \$495.

SOFTWARE ROUTER, Jul 93

Apple Internet Router 3.0; Apple Computer, 408/996-1010; Basic Connectivity Package \$499.

TERMINAL EMULATOR, Oct 93

VersaTerm; Synergy Software, 215/779-0522; \$149.

GRAPHICS

2-D CAD, Jan 93

Low-end: BluePrint; Graphsoft, 410/461-9488; \$295.

Midrange: PowerDraw; Engineered Software, 919/299-4843; \$795.

3-D DESIGN, Aug 93

Price for performance: ♦ Ray Dream Designer 2.0.4; Ray Dream, 415/960-0765; \$299. ♦ Alias Sketch 1.5; Alias Research, 416/362-9181; \$995.

All-in-one solution: ♦ Infini-D 2.5; Specular International, 413/549-7600; \$995. ♦ StrataVision 3D 2.6.1; Strata, 801/628-5218; \$995.

CLIP ART'S GREATEST HITS, Jan 94

Overall collection: ♦ ClickArt Studio Series; T/Maker Company, 415/962-0195; \$99.95 per volume. ♦ Electronic Clipper subscription service; Dynamic Graphics, 800/255-8800; \$67.50 per month. ♦ Metro ImageBase Electronic Clip Art; Metro ImageBase, 800/525-1552; \$74.95 per volume, CD-ROM \$149.95. ♦ Images with Impact series; 3G Graphics, 800/456-0234; \$99.95 to \$129.95 per volume, CD-ROM \$499. ♦ Typographers' Ornaments; Underground Grammarian, 609/589-6477; \$25 per volume; ten TIFF albums \$200; EPS volumes \$50 each.

DRAWING PROGRAMS (LOW-COST), Sep 93

Budget draw: Expert Draw; Expert Software, 305/567-9990; \$49.95.

Budget draw/paint: UltraPaint; Deneba Software, 305/596-5644; \$79.

Beginners' program: Aldus SuperPaint; Aldus Corp., 619/558-6000; \$149.95.

Overall: Canvas; Deneba Software, 305/596-5644; \$399.

IMAGE DATABASES, Oct 93

♦ Aldus Fetch 1.0; Aldus Corp., 206/628-5739; \$295. ♦ Multi-Ad Search 2.0; Multi-Ad Services, 309/692-1530; \$249.

PAINT AND IMAGE-EDITING, Sep 93

Budget buy: Expert Color Paint; Expert Software, 305/

567-9990; \$49.95.

Overall program: Fractal Design Painter; Fractal Design Corp., 408/688-8800; \$399.

Image-editing program: Adobe Photoshop 2.5.1; Adobe Systems, 415/961-4400; \$895.

INTEGRATED SOFTWARE

INTEGRATED SOFTWARE, Feb 94

ClarisWorks; Claris Corporation, 408/727-8227; \$299.

ORGANIZATION/PRODUCTIVITY

CALENDARS, Jul 93

Alarm system: ♦ First Things First; Visionary Software, 503/246-6200; \$79.95. ♦ Smart Alarms Plus; JAM Software, 203/630-0055; \$75.

All-around scheduler: Now Up-to-Date; Now Software, 503/274-2800; \$99.

Meeting scheduler: Meeting Maker; On Technology, 617/374-1400; five-pack \$495.

PERSONAL INFORMATION MANAGEMENT, Feb 93

TouchBase/DateBook; After Hours Software, 818/780-2220; \$169.95.

SALES-AUTOMATION SOFTWARE, Oct 93

♦ Contact Ease; WestWare, 619/660-0356; one user \$395, five users \$1495. ♦ CBS; Colleague Business Software, 512/345-9964; \$495.

TEXT-RETRIEVAL SOFTWARE, Dec 93

Small system: On Location; On Technology, 617/374-1400; \$129.

Multituser system: Personal Librarian; Personal Library Software, 301/990-1155; \$995.

PRESENTATION TOOLS

MULTIMEDIA AUTHORIZING, Mar 93

Entry-level: ♦ Action; Macromedia, 415/252-2000; \$495.

♦ Passport Producer; Passport Designs, 415/726-0280; \$495.

UTILITIES

BRAVE NEW DOCUMENTS, Jan 94

Application-independent document distribution: Common Ground; No Hands Software, 800/598-3821; \$189.95.

Book-length documents: FrameReader; Frame Technology, 800/843-7263; \$84.95

PRINTING, Sep 93

PC-printer cable packages: PowerPrint; GDT Softworks, 604/291-9121; \$149.

SECURITY, Feb 93

File encryption and erasure: Citadel with Shredder; Datavatch Corp., 919/549-0711; \$99.95.

Full-featured security: ultraSecure; usrEZ Software, 714/756-5140; \$239.

Low-cost security: PassProof; Kensington Microware, 415/572-2700; \$64.95. **m**

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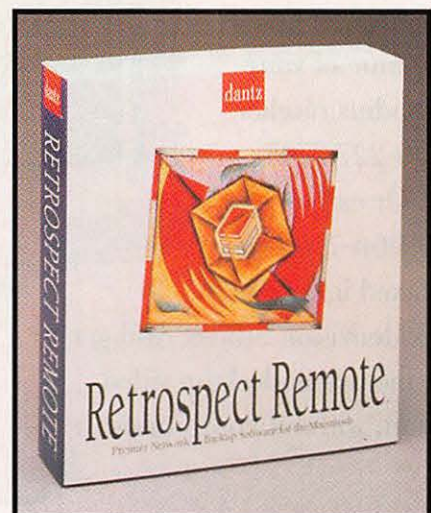
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★★★★★ |-----| ★
Best Worst

Software

BUSINESS TOOLS

★★★★ 4D Server 1.0.1, ACI US, 408/252-4444, \$1495 to \$3495. Database server uses the ingenious multitasking technology built into 4D to make it appear that each client has the full resources of the server. If you use 4D on a network, you need this product. Jun 93

★★★★ 4th Dimension 3.0.1, ACI US, 408/252-4444, \$895. Multitasking, which greatly improves speed, makes this upgraded relational database delightful for both developers and end users. For a relational database, it's impressively easy to use. Apr 93

★★ AccuZip 6 1.5.2, Software Publishers, 714/846-1908, \$899. Professional-level mail-list management tool on CD-ROM is the most comprehensive system available, but its inexcusable user-interface violations make our reviewer reluctant to recommend it. May 93

★★★ Acrobat Exchange, Acrobat Distiller, Adobe Systems, 415/961-4400, \$195 to \$2495. Complete, well-planned paperless office system creates application-independent viewable files that can be readily distributed on a network. Still, it's not yet as inexpensive or as convenient as you might wish. Oct 93

★★★★ @Risk 1.1, Palisade Corp., 607/277-8000, \$395. Statistical simulator for Microsoft Excel financial computations generates complex, statistically valid templates within Excel and is the first choice for analysts who work with probabilistic models every day. It assumes that the user is an Excel power user. Aug 93

★★★★ ClarisWorks 2.0, Claris Corp., 408/727-8227, \$299. Integrated program provides more features, is easier to use and faster, and has better integrated modules than other available programs. Aug 93

★★★★ Common Ground 1.0, No Hands Software, 415/321-7340, \$189.95. Simple, robust document interchange system is the clear choice for modest document-distribution jobs. In tests, it worked easily with documents from many different applications. Oct 93

★★ EasyFlow 1.1, HavenTree Software, 613/544-6035, \$229. The rough edges and distinctly un-Mac-like attributes of this flowcharting software reflect its DOS heritage, but on the whole it's easy to use. Sep 93

★★★★ Helix Express 1.0, Helix Technologies, 708/205-1669, \$439. This relational database has an iconic programming language that sometimes baffles programmers, but provides an easy route into basic data-handling for nonprogrammers. Jul 93

★★★★ Helix Tracker 1.0, Helix Technologies, 708/465-0242, \$439. Well-designed workgroup-document manager has strong audit and annotation features; imposes just the right amount of administrative discipline. For large documents, however, Ethernet will look mighty attractive. Nov 93

★★★★ iThink 2.2.1, High Performance Systems, 603/643-9636, \$695. Although it requires a real training commitment for effective use, this product is an attractive dynamic business modeling system. It's a good bet for identifying cloudy spots in the crystal ball. May 93

★★ Lotus Notes 3.0, Lotus Development Corp., 617/577-8500, \$495 per client. Well-organized, robust, and flexible business data system demands a full-time administrator, preferably with considerable programming experience, for effective use. Sep 93

★★★★ MacBarcode 2.24, ComputaLabel, 508/462-0993, \$349 to \$895. Simple-to-use desk accessory creates bar codes in EPS or Adobe Illustrator 1.1 format. DA cannot automatically create serial codes. Jun 93

★★★★ MacProject Pro, Claris Corp., 408/727-8227, \$599. If you're working on a midsize project and like using PERT charts, this may be the project-management software for you. However, the multistep scheduling process and the limited integration between charts are frustrating if you prefer Gantt charts. May 93

★★★★ MarcoPolo 2.0, Mainstay, 805/484-9400, \$395. Inexpensive, easy-to-use product allows you or your workgroup to archive and retrieve documents, whether in electronic or paper form. Queries are easy to construct and searches are handled quickly. Sep 93

★★★★ Market Master Manager 3.5, Breakthrough Productions, 916/265-0911, \$595. Sales-automation software is designed to keep track of contacts, generate mailings, and make sure that leads don't fall through the cracks. It includes a remote module, but it has

some odd user-interface features. Oct 93

★★ Memorizer 2.0, Brains Software Engineering, 432-231-28973 (Austria), \$100. Software records dictation and you transcribe the dictation in a word processor. You may prefer to stick with a hand-held tape recorder, considering the product's RAM and storage appetite, and its propensity to crash. Aug 93

★★★★ Micro Planner Manager 1.1, Micro Planning International, 303/757-2216, \$695. When you require cross-project resource sharing and leveling for a reasonable price, this project-management software has the edge. It has a generally intuitive interface, though there's a steep learning curve for its advanced features. Nov 93

★★★★ Microsoft Works 3.0, Microsoft, 206/882-8088, \$249. Capable upgrade delivers marginally improved functionality and a welcome face-lift to this integrated program, but there are a number of incompatibilities, odd design choices, and performance flaws. Feb 93

★★★★ Office Tracker 1.1, Milum Corp., 512/327-2255, \$195 to \$595. The efficient user interface of this software sign-out board, in both single-user and networkable versions, makes it easy to learn and use; but it has some minor flaws. Dec 93

★★★★ OrgChart Express 1.0, Kaetron Software, 713/890-3434, \$279. Organization-chart software links a database to standard box-drawing functions. Although the learning curve is steep, the effort may be worth it for people who regularly work with large or complex organization charts. Apr 93

★★★★ Project Scheduler 5, Scitor Corp., 415/570-7700, \$695. For most midrange project-planning, this program's many hits outweigh its few misses. It goes beyond the requisite scheduling options, with inflation factors and unlimited projects in memory, and it conforms to accepted standards, so you get consistent, predictable results. Aug 93

★★★★ SpreadBase 1.0.1, Objective Software, 415/306-7410, \$695. Business data-analysis tool is a unique combination of database and spreadsheet functions. It's worth a close look for power users, despite meager documentation and a cranky macro language. May 93

★★ Useful Voice Processor for Macintosh 1.1v7, Useful Software Corp., 508/774-8233, \$179.95. Dictation software lets you record and transcribe on a Mac. It has some useful features, but you must take uncommon care to avoid crashes. Dec 93

★★★★ Wingz 1.1ae, Informix Software, 913/599-7100, \$399. Low-overhead spreadsheet offers advanced-math functionality, a competent calculating engine, and superior charts; but spreadsheet is missing outlining, real 3-D spreadsheet linking, and the host of third-party add-ons offered for Microsoft Excel. Jul 93

★★★★ WordPerfect Works 1.2, WordPerfect continues

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Star Ratings

Corp., 801/225-5000, \$249. This program offers seven well-integrated and flexible modules. It has a few shortcomings, including some memory-management problems, but buyers should generally be pleased. **Jun 93**

COMMUNICATIONS/NETWORKS

★★★★ **EtherPeek 2.0.3, LocalPeek 2.0.3, TokenPeek 1.0 (2.0.3), AG Group, 510/937-7900, \$495 to \$995.** Priced at a fraction of the cost of dedicated hardware analyzers, these network analyzer tools give you better analysis with a friendlier interface. They're a worthwhile investment. **Jan 94**

★★★★ **MicroPhone Pro, Software Ventures Corp., 510/644-3232, \$295.** Truly comprehensive telecommunications package now includes send-and-receive fax software. Although the new TCP/IP tools are complicated, the documentation is clear and precise. **Apr 93**

★★ **NetVirtual 2.0, Eclectec, 408/462-2040, \$995 to \$4985.** One-of-a-kind network-simulation product favors flexibility at the expense of usability. Only after hours of work will your simulation report anything meaningful about your network, and even then the results are difficult to analyze. **Apr 93**

★★★★ **Network Vital Signs 1.0 (1.1), Dayna Communications, 801/531-0600, \$449.** Fault-monitoring application continually watches selected network devices, monitoring for specific errors. Unfortunately, when monitoring more than ten devices, it noticeably degrades the performance of the monitoring Mac. **Mar 93**

★★★★ **On the Air 1.0.1, Digital Eclipse Software, 510/547-6101, \$79.99 to \$639.99.** Intercom system transmits System 7 SND resources, SoundEdit, and AIFF sound files across a network. It's well designed and performs decently, but its usefulness seems limited. **Aug 93**

★★★★ **On the Road 1.1, Connectix, 415/571-7100, \$99.** Helpful PowerBook utility looks at what's hooked up to your computer and adjusts accordingly—for example, printing when a printer is available and otherwise deferring printing. It only supports some hardware, however, so check before buying. **Dec 93**

★★ **SoftPC with Windows, Insignia Solutions, 415/694-7600, \$499.** The emulation of a complete and accurate Windows environment on a Mac is an amazing accomplishment, but the product is so slow, even on a Quadra, that it performs in what might best be characterized as a dreamlike languor. **Jun 93**

★★★★ **Timbuktu 5.0.1, Farallon Computing, 510/814-5000, \$199 to \$5500.** By letting one computer (a Mac or a Windows-based PC) control, observe, or exchange data with another computer, this terminal-emulation product allows you to use resources almost anywhere on a network. **Mar 93**

★★★★ **VersaTerm 5.0, Synergy Software, 215/779-0522, \$195 to \$295.** The price and feature set of this network terminal-emulation package make it a terrific value, in spite of its complex documentation and limitations. If you're looking for a fast path to Internet connectivity, this is it. **Jan 94**

DESKTOP PUBLISHING

★ **AboutFace 1.1.1 (1.1.2), Big Rock Software, 716/288-2860, \$69.95.** Type-specimen generator has many serious deficiencies that need to be addressed. **Jan 94**

★★★★ **Aldus Fetch 1.0, Aldus Corp., 206/622-5500, \$295.** The rich feature set and network support of this image-cataloging software make it a clear winner. Although cataloging is slow, users have fine control of the depth and compression of thumbnails. **Aug 93**

★★★★ **Aldus PageMaker 5.0, Aldus Corp., 206/622-5500, \$895.** Desktop publishing software has added the features, both great and small, that it's been lacking, while still retaining the ease-of-use advantages that it's always had. This is a superb upgrade. **Nov 93**

★★ **Aldus Personal Press 2.0, Aldus Corp., 206/628-2320, \$199.** Basic, inexpensive page-layout program gains strength, but is missing elements that novice users need, such as automatic kerning. Its software-knows-best approach to copyfitting makes manual fine-tuning difficult and is likely to confuse beginners. **Mar 93**

★★★★ **Apple Font Pack, Apple Computer, 408/996-1010, \$99.** Apple's first collection of TrueType fonts includes only 12 fonts that haven't been available since the late eighties in the PostScript format. Still, it's not a bad deal, considering that Adobe PostScript fonts cost four times as much. **Mar 93**

★★★★ **Cumulus 1.1, Canto Software, 415/431-6871, \$295.** Good network support, plus a feature that creates a protocol file for recording user actions, make this image-cataloging program a good choice for workgroups. It doesn't have an image preview feature, or offer 32-bit thumbnails. **Aug 93**

★★★★ **Expanded Book Toolkit 1.0.1, The Voyager Company, 310/451-1383, \$295.** Using this hypermedia publishing program, average mortals can create highly functional multimedia books in a fraction of the time it would take to do the job unassisted. Be aware, though, that it's no QuarkXPress. **Jun 93**

★★★★ **FontMonger 1.5.7 (1.5.9), Ares Software Corp., 415/578-9090, \$149.95.** Font-conversion utility provides cross-platform, cross-font conversion and makes it easy to create composite, subscript, superscript, and rotated characters. **Sep 93**

★★ **ImageAccess 1.0, Nikon, 516/547-4355, \$495.** This expensive image-cataloging program has an unusual interface and cannot be used over a network. A plug-in module provides direct support for Nikon's LS-3510AF film scanner. **Aug 93**

★★★★ **Kodak ColorSense 1.0, Eastman Kodak, 716/253-0740, \$499.** Color-management system gives average users access to a reasonable level of color consistency at a reasonable price. It does not make color separations. **Oct 93**

★★ **Kudo Image Browser 1.0, Imspace Systems Corp., 619/272-2600, \$295.** This image-cataloging software cannot control thumbnail depth or compression, and doesn't have a keyword feature or allow multiple users to access the catalog simultaneously. The unique Riffle feature lets you quickly scan images. **Aug 93**

★★★★ **Lazy Dog Foundry Personal Font, Lazy Dog Foundry, 612/291-0306, \$199.99 to \$499.99.** Type 1 font made from your handwriting has clean, even lines—whether or not your writing does. **Apr 93**

★★★★ **Publish It Easy 3.0, Timeworks, 708/559-1300, \$199.95.** Desktop-publishing program offers writing, editing, formatting, page-layout, drawing, and painting tools with well-thought-out interface innovations, plus an excellent database manager. Unfortunately, the program is unstable and crash-prone. **Mar 93**

★★★★ **QuarkXPress 3.2, Quark, 303/894-8888, \$895.** This upgrade adds the EfiColor XTension to ensure the greatest possible fidelity of color images and is a must-have for professional color publishers who use Quark. For others, the enhancements are welcome but minor enough that they provide little incentive to upgrade. **Nov 93**

★★★★ **SuperATM, Adobe Systems, 415/961-4400, \$149.** This upgrade to Adobe Type Manager lets you view Adobe-brand PostScript fonts on screen and output them at high resolutions, even when the corresponding printer fonts are unavailable. Although it has limitations, this is an outstanding advance in font technology and a tremendous value. **May 93**

★★★★ **Tableworks Plus 1.05, Npath, 206/392-7745, \$299.** Publishing utility adds a full table-editor to QuarkXPress and is a must-have for anyone doing even mildly complex tables. **Jan 94**

EDUCATION

★★★★ **Algebra, Broderbund Software, 415/382-4400, \$89.95 to \$99.95.** Interactive, imaginative math tutorial is keyed to the standard textbook order of topics, but offers much more. It is particularly strong on word problems and graphing. **May 93**

★★ **Comprehensive Review in Biology, Queue, 203/335-0908, \$295.** There isn't a textbook publisher in North America with the nerve to publish a black-and-white biology book with nothing more than text and basic line drawings, much less charge several hundred dollars for it, but that, in effect, is what this CD-ROM is. **May 93**

★★★★ **Compton's Multimedia Encyclopedia 1.00M, Compton's New Media, 619/929-2626, \$795.** The down-to-earth writing style and numerous bells and whistles of this multimedia encyclopedia on CD-ROM appeal to younger readers, but the high cost and sluggish performance may be prohibitive. **Apr 93**

★★★★ **Decimal & Fraction Maze 1.2, Great Wave Software, 408/438-1990, \$69.95 to \$89.95.** Education software weaves the threads of eight math curricula—from third grade to eighth, along with two levels of adult education—into an interesting and visually stimulating game. **Jul 93**

★★ **Dvorak on Typing 1.0, MacPlay, 714/553-3530, \$49.95.** Typing tutor offers solid lessons, but the small annoyances, such as never being able to take intermediate or advanced lessons without first passing a test, add up. **Jun 93**

★★★★ **How Computers Work, Time Warner Interactive Group, 818/955-9999, \$79.99.** Graceful, well-integrated CD-ROM tutorial guides the curious through brief but helpful explanations of basic computer technologies. **Jan 94**

★★ **HyperStudio, Roger Wagner Publishing, 619/442-0522, \$179.95.** Hypermedia authoring tool supports color and many multimedia functions through easy-to-use dialog boxes, but the interface doesn't always follow Apple guidelines. **Dec 93**

★★★★ **MacGlobe 1.3.0, Broderbund Software, 415/382-4400, \$44.95.** Besides maps and bits of fun, such as national anthems, this geography software offers an impressive quantity of demographic and economic information. Its data export could use some work. **Feb 93**

★★★★ **Mavis Beacon Teaches Typing 2.0, continues**

Star Ratings

The Software Toolworks, 415/883-3000, \$49.95.

If being entertained while learning to type interests you, this typing tutor provides varied environments, interesting lessons, and good games. Jun 93

★★★ **Millie's Math House, Edmark Corp., 206/556-8400, \$49.95.** Math-education software provides ways for preschoolers to experiment with numbers and counting. It's engaging, but more advanced levels would keep children challenged longer. Jul 93

★★★★ **The New Grolier Multimedia Encyclopedia, Grolier Electronic Publishing, 203/797-3530, \$395.** The scholarly text of this encyclopedia on CD-ROM is suitable for sophisticated readers, while its speed, ease of use, and value are impressive. Apr 93

★★★★ **The Rosetta Stone, Fairfield Language Technologies, 703/432-6166, \$395.** Foreign-language instruction on CD-ROM is a valuable educational tool and fun to use. The lessons are well paced, and the content is generally excellent and diverse. Jan 94

★★ **The Secret Codes of C.Y.P.H.E.R. 1.0 (1.1), Tanager Software Productions, 510/430-0900, \$59.95.** Intriguing facts about mammals and a variety of alphabets provide the interest in this educational game, but the inescapable, repetitive animations are a major distraction. Apr 93

★★★ **The Secret Island of Dr. Quandary 1.0 (1.01), MECC, 612/569-1500, \$49.95 to \$69.95.** Clever package of gorgeous landscapes, catchy sounds, and tempting arcade-game puzzles uses math, logic, and reading skills. Although slow, it's fun. Jun 93

★★★ **Stickybear's Reading Room 2.2a, Optimum Resource, 803/785-7441, \$59.95.** Educational game with four activities takes a sedate but direct path to building primary-level reading skills. Jun 93

★★★★ **Where in America's Past Is Carmen Sandiego? 1.0 (1.3), Broderbund Software, 415/382-4400, \$44.95.** Travel in time and the U.S. chasing those V.I.L.E. crooks in this clever educational history/geography game that's challenging for all ages. Mar 93

ENTERTAINMENT

★★★★ **A-Train, Maxis, 510/254-9700, \$69.95.** Charming railroad simulation offers astonishing, and often witty detail, but the learning curve is high and the interface isn't completely Mac-like. Apr 93

★★ **America Alive, MediaAlive/CD Technology, 408/752-8500, \$99.** QuickTime movies, photographs, maps, text, and audio mingle in this multimedia CD-ROM guide to the U.S. It's a promising concept, but it doesn't yield much useful information. Mar 93

★★★★★ **Arthur's Teacher Trouble, Broderbund Software, 415/382-4400, \$59.95.** Every page of this delightful animated book is dense with surprises that arouse and satisfy a child's curiosity. In the words of six-year-old Alex, "It's like chocolate ice cream. You can have it more than once and it's still good." Apr 93

★★★ **Battle Enhanced Chess CD ROM, Interplay Productions, 714/553-6678, \$79.95.** Elaborately detailed cartoon characters act out little dramas of strategy and capture, complete with sound effects, in this chess game that will drive nine-year-olds mad with glee but may annoy experienced chess players. Mar 93

★★★ **BlackJack Trainer, ConJelCo, 412/492-9210, \$75.** Learn the strategies you need to win at

blackjack with this program. There are a number of trivial bugs, but they won't get in the way. Oct 93

★★★ **Cogito 1.0, Inline Design, 203/435-4995, \$59.95.** Rubik's Cube fans will like this challenging game where the goal is to replicate a pattern by moving rows and columns of tiles. It gets more and more complex as you progress through the 120 levels. Apr 93

★★★ **Daily Sports Quiz 1.0, DreamTime, 619/236-1341, \$49.95.** If you think you know a lot about sports and love to play trivia games, then this entertaining and informative game is for you. Oct 93

★★★★ **Falcon MC 1.0, Spectrum HoloByte, 510/522-1164, \$69.95.** Whether you're an armchair jet jockey or an experienced fighter pilot, you're bound to be impressed by the 4-bit color, enhanced graphics, and sophistication of this latest incarnation of the original Macintosh combat flight simulator. Dec 93

★★★ **Hell Cab 1.0.2, Time Warner Interactive Group, 818/955-9999, \$99.99.** Take a diabolical New York cabbie with a penchant for time travel, toss in the Empire State Building, add a few brainteasers, and you've got this engaging game on CD-ROM. It's slow and the arcade sections are hard to control, but overall it succeeds. Jan 94

★★★★ **Hellicats Over the Pacific 1.0.3, Graphic Simulations, 214/699-7400, \$69.95.** Fly a WWII-era Navy fighter, the Grumman F6F Hellcat, against enemy planes in the South Pacific with this flight simulator that offers smooth graphics, good special effects, and great documentation. Apr 93

★★★ **Indiana Jones and the Fate of Atlantis, LucasArts Games, 415/721-3300, \$59.95.** In this game, the whip-wielding archaeologist goes looking for Atlantis and finds it armed to the gills with magical technology and Nazi stooges. If you're not bothered by the story's astonishing sexism, you'll find it diverting. Oct 93

★★★★ **Insanity 1.0, UV Wave, 318/868-9944, \$39.95.** Shoot your Mac with this cool control panel device that offers a choice of nine weapons, ranging from an Uzi to a pigeon. It has first-rate sound effects and detailed animation, but the novelty wears off. Feb 93

★★★★ **Jewelbox 1.5, Varcon Systems, 619/563-6700, \$49.95.** This gem of a game is strongly reminiscent of Tetris. The jewels fall into rows that disappear when you place three jewels of a kind together. Jun 93

★★★ **The Journeyman Project, Presto Studios, 619/689-4895, \$99.95.** Interactive science-fiction epic on CD-ROM is a work of art. The scenes are rich with painstakingly detailed graphics, elaborate models, and subtle textures, but the sluggish pace may leave you impatient and bored. Sep 93

★★★★ **Maelstrom 1.03, Ambrosia, P.O. Box 23140, Rochester, NY 14692-3140, \$15 plus \$5 shipping and handling.** Fast-paced arcade game is loosely modeled after Asteroids, the Atari classic. Maelstrom features superb animation, hilarious sound effects, exciting action—and best of all, it's shareware. Jun 93

★★★★ **Monkey Island 2: LeChuck's Revenge, LucasArts Games, 415/721-3394, \$59.95.** This whimsical Twilight Zone of life on the sea is the adventure-game equivalent of *Mad* magazine, filled with splendid gross-out jokes, heapings of self-parody, and enough hilarious detail to keep you amused for days. May 93

★★★ **Mozart: The "Dissonant" Quartet, The Voyager Company, 310/451-1383, \$59.95.** CD-

ROM includes an unusual essay on stringed instruments, discussions of general musical concepts, an analytical overview of the quartet, and a taped minilecture on Mozart; but the music is limited almost entirely to the title piece. Apr 93

★★ **The Orchestra: The Instruments Revealed, Time Warner Interactive Group, 818/955-9999, \$79.98.** The many-branched, interwoven, hypertext style of this music-education CD-ROM makes it hard to navigate and digest, despite its richness. For the price, other music-education CD-ROMs present better values. Apr 93

★★★★ **Poetry in Motion, The Voyager Company, 310/451-1383, \$29.95.** Performance videos of contemporary poets are juxtaposed with the texts of their poems and taped interviews in this intriguing CD-ROM that combines the excitement of the stage with the reflective appeal of the page. Feb 93

★★★★ **Richard Strauss: Three Tone Poems, The Voyager Company, 310/451-1383, \$59.95.** *Don Juan*, *Till Eulenspiegel*, and *Death and Transfiguration* are included in this CD-ROM. The musical analysis is satisfying, and the lush orchestral music will appeal to both novice and experienced classical music listeners. Apr 93

★★★ **Rodney's Wonder Window, The Voyager Company, 310/461-1383, \$39.95.** Collection of 23 colorful, wacky graphics and animations by Rodney Alan Greenblatt is charming but uneven. While some modules are elaborate and sophisticated, others are simple and not particularly interesting. Mar 93

★★★ **Schubert: "The Trout" Quintet, The Voyager Company, 310/451-1383, \$59.95.** Alan Rich, classical music commentator for NPR, conveys his enthusiasm for this appealing music in this CD-ROM's lively text. The discussion is relatively unchallenging, and the performance is not at the top of most reviewers' lists. Apr 93

★★★★ **Seven Days in August, Time Warner Interactive Group, 818/955-9999, \$79.99.** Compelling, interactive documentary on CD-ROM cuts a slice from history and offers August 10 through August 16, 1961, (the building of the Berlin Wall) to viewers in a way that truly evokes the period. Oct 93

★★★★ **Sherlock Holmes, Consulting Detective, Volume II, Icom Simulations, 708/520-4440, \$69.95.** Match wits with the legendary detective by solving three difficult mysteries in this CD-ROM game. May 93

★★★ **SimLife, Maxis, 510/254-9700, \$69.95.** A megalomaniac's dream come true, this amazingly intricate simulation lets players create and control ecosystems. It's not easy, but the reward is an increased understanding of the complex interrelationships of life. Feb 93

★★★★ **So I've Heard, Volume 1: Bach and Before, The Voyager Company, 310/451-1383, \$24.95.** Engaging text describes nearly two millennia of western music (up to the mid-eighteenth century) in this CD-ROM. It offers a unique opportunity to sample 50 or so performances, styles, and compositions. Feb 93

★★★ **Space Quest 1: Roger Wilco in the Sarien Encounter, Sierra Online, 209/683-8989, \$19.95.** As Roger Wilco, starship janitor, you must defeat the evil Sariens in this adventure game where your head is more important than your hands. For most players the game will be easy to complete. Apr 93

★★★★ **Spectre Supreme, Velocity Development, 415/274-8840, \$69.95 to \$89.95.** The pleasure of this game comes not in high scores, but in the *continues*

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Star Ratings

almost addictive sense of control you get from moving your tank around the screen. It's so much fun that it's even fun when you lose. Dec 93

★★★★ **Super Mines 1.0, Callisto Corp., 508/655-0707, \$49.95.** You use logic to search a minefield without setting off mines in this fast-paced game that's easy to learn, but offers 84 levels for long playability. Apr 93

★★★★ **V for Victory: Utah Beach, Three-Sixty Pacific, 408/879-9144, ext. 23, \$69.95.** The post-D-Day conquest of Normandy is re-created in this game; its strength is the way it blends easy play with complicated strategy. Some bugs exist. Oct 93

★★★★ **Who Killed Sam Rupert, Creative Multimedia Corp., 503/241-4351, \$39.99.** You're a police detective trying to solve the murder of a popular restaurateur in this interactive CD-ROM that exploits the full range of multimedia options and provides a wealth of clues and surprises to hold your interest. May 93

FINANCE/ACCOUNTING

★★ **Andrew Tobias' TaxCut for Macintosh, MECA Software, 203/256-5000, \$79.95.** The occasionally awkward interface of this personal tax-preparation software doesn't follow every Mac standard, but the help system is very good. State versions are available for California and New York. May 93

★★★★ **BestBooks 1.0, Teleware, 201/586-2200, \$99.** In a straightforward, unimposing manner, this small-business accounting program integrates the standard bookkeeping functions of accounts receivable, accounts payable, and general ledger. Jul 93

★★ **Business Sense 1.6, Software Developers Consortium, 801/288-2216, \$199.** Competent, single-user, all-in-one bookkeeping package will adequately help you keep the books for a small company, but it's not as easy to use as its competition. Feb 93

★★★★ **MacInTax 1992, ChipSoft, 619/453-8722, \$79.95.** It's difficult to correct your errors when using this personal tax-preparation software, but it's easier than doing your taxes by hand. The display is attractive and the program supports electronic filing. May 93

★★★★ **Quicken 4, Intuit, 415/898-6095, \$69.95.** Personal-finance software is powerful and easy to learn, even for a financial neophyte. Although slower than previous versions, 4.0 lives up to its promise of making financial chores easier and better organized. Nov 93

★★★★ **WealthBuilder 2.0, Reality Technologies, 800/346-2024, \$79.99.** Financial-planning software forces you to think about your money and helps you develop an investment plan. It's a good program for beginning investors, but more-sophisticated investors will want more-advanced features. May 93

GRAPHICS

★★★★ **addDepth 1.0.2, Ray Dream, 415/960-0768, \$179.** The purpose of this graphics program is to enhance the creation of 2-D images with 3-D effects. It's versatile, accommodating, and affordable, but working on complex images gets tedious because of the automatic application of styles. Aug 93

★★★★ **Adobe Dimensions, Adobe Systems, 415/961-4400, \$199.** This three-dimensional-effects utility may seem very limited, with white-only light and no

surface texturing, but it's a ground-breaking product. It performs its 3-D illusions within the object-oriented, resolution-independent world of PostScript. Apr 93

★★★★ **Adobe Illustrator 5.0, Adobe Systems, 415/961-4400, \$595.** The Mac's most dependable draw program has added enough new features to boggle the mind. It still can't import TIFF images, but it catches up with, and in some areas surpasses, the competition. Nov 93

★★★★ **Adobe Photoshop 2.5, Adobe Systems, 415/961-4400, \$895.** No graphics program is as universally loved as this one, but while this upgrade builds on the program's capabilities, it ignores some minor weaknesses that have begun to peek through the product's armor. It's still great but perhaps not perfect. Jun 93

★★★★ **Alias Sketch 1.5, Alias Research, 416/362-9181, \$995.** The enhanced modeling and revamped rendering capabilities of this 3-D illustration program contribute to a tremendous and reliable upgrade, a heartening example of a company listening to its users. Jul 93

★★ **ArtBeat Professional 1.0, Pie Practical Solutions, 201/902-9500, \$249.** Despite a smattering of unique capabilities, this inexpensive draw/paint program lacks features of equivalent programs. Apr 93

★★★★ **artWorks 1.0, Deneba Software, 305/596-5644, \$149.** If you're expecting a graphics dynamo, this combination paint and draw program will leave you a little cold. Despite its flaws, it ranks as one of the best graphics programs available under \$200. Jun 93

★★★★ **Blueprint 4.0, Graphsoft, 410/461-9488, \$295.** Entry-level 2-D drafting program is a wonderful antidote to the complicated CAD system blues. Don't be misled by the low price: this full-fledged drafting package is powerful enough to serve professionals who appreciate the value of simplicity. Jul 93

★★ **BrushStrokes 1.0, Claris Clear Choice, 408/727-8227, \$139.** If you have absolutely no experience with computer graphics, the simplified interface of this 24-bit paint program might warrant its price. Otherwise, you can find better programs for less. Oct 93

★★★★ **CA-Cricket Draw III 2.0, Computer Associates International, 516/342-5224, \$249.** Draw program is not going to inspire experienced Mac artists to jump up and down, but its features are abundant, the interface is straightforward, and the price is right. Oct 93

★★★★ **Canvas 3.5, Deneba Software, 305/596-5644, \$399.** Draw program offers two to three times as many features as any competing program, but our reviewer would prefer an interface that you can navigate without scrambling for the manual. Jan 94

★★★★ **Color It 2.0.1, Timeworks, 708/559-1300, \$299.95.** Overpriced color paint program has a full range of painting and image-retouching capabilities, including 15 levels of undo and an impressive magic-wand tool, but its naming conventions are bewildering. Apr 93

★★ **ColorUp 1.0, Pantone, 201/935-5500, \$99.95.** Professional graphic designers don't need the advice of this color tutorial and series of palettes. Although nonprofessionals might benefit from the information on color theory, it may not be worth the money. Nov 93

★★ **CPM Graphic Tutor 1 & 2, Caseys' Page Mill, 303/220-1463, \$489 per volume.** Although some neophytes may find these CD-ROM tutorials on Adobe Illustrator and Adobe Photoshop helpful, the programs' distracting interfaces, inconsistent execution, lack of polish, and high price weigh strongly against them. May 93

★★★★ **DeBabelizer 1.5, Equilibrium Technologies, 415/332-4343, \$299.** Bitmapped-graphics-conversion software supports a huge number of file formats and can work wonders. If you spend any significant time dealing with file conversion, you should have this program. Nov 93

★ **Easy Color Paint 3.0, MECC, 612/569-1500, \$59.95.** For a program that purports simplicity, this color paint program is anything but. Possibly the weakest, least intuitive paint program for the Mac, it's unnecessarily complex and frustrating. Jul 93

★★★★ **Electric Image Animation System 1.5.1, Electric Image, 818/577-1627, \$7495.** The most powerful animation program for the Mac improves its documentation and rendering, and adds an intuitive project window. Unfortunately, it still retails for the price of a European vacation for two. Feb 93

★★★★ **Expert Draw 1.0, Expert Software, 305/567-9990, \$49.95.** Inexpensive draw program is not really for experts, but it offers a decent, no-frills set of basic drawing tools and commands for beginning illustrators, office use, or anyone on a budget. Aug 93

★★★★ **Folio 1 Media Kit-Print Pro, D'Pix, 614/299-7192, \$499.95.** Each image in this texture collection on three CD-ROMs provides a dynamic range of colors, highlights, and shadows; is free of artifacts; and is crisply focused. Aug 93

★★★★ **Fractal Design Painter 2.0, Fractal Design Corp., 408/688-8800, \$399.** If you can put up with a few inconveniences, this color paint software provides the tools required by professional artists, and many of its functions—natural-media brush tools, the color-sensitive magic wand—are entirely without peer. Jul 93

★★★★ **Generic CADD 2.0, Autodesk, 206/487-2233, \$495.** Competent, midlevel 2-D drafting program has a well-executed Mac interface, a good complement of tools, and a sprinkling of high-end features, such as floating-point precision. Aug 93

★★ **Image Assistant 1.0, Caere Corp., 408/395-7000, \$495.** Besides unsatisfactorily addressing Adobe Photoshop's small list of liabilities, this image-editing software's problems include an unforgivable lack of antialiased text, no selective revert function, and an incorrectly implemented smudge tool. Apr 93

★★★★ **Kai's Power Tools Volume 1 1.0 (2.0), HSC Software, 310/392-8441, \$149.** Although at times monstrously complicated, this collection of Photoshop plug-ins represents a virtually infinite supply of visual resources. It's an amazing tool that no regular Photoshop user should be without. May 93

★★★★ **MiniCAD+ 4, Graphsoft, 410/461-9488, \$795.** Professionals will appreciate this highly competent CAD package's evolution into 3-D. It maintains its features-champion status and is easier to use. Mar 93

★★★★ **Ofoto 2.0, Light Source Computer Images, 415/461-8000, \$395.** Many new features—notably color support—have been added to the already impressive toolbox of this scanning software. It often produces good results, but it rarely produces the best scan possible for a given image and output method. Jul 93

★★★★ **Paint It 1.0, Timeworks, 708/559-1300, \$59.95.** Straightforward color paint program lacks image-editing tools but has a versatile cast of selection and painting tools—and it's priced to sell. Apr 93
continues

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Star Ratings

★★★★ **PosterWorks 3.0**, S. H. Pierce & Co., 617/338-2222, \$395. This large-format graphics production tool is for people who think big, up to 10,000 square feet big. It fills the need for user-defined, full-color, large-format output robustly and elegantly. Aug 93

★★★★ **PowerDraw 4.0, Engineered Software**, 919/299-4843, \$795. The best new feature of this polished 2-D drafting program is an open architecture that supports modules that let you customize the program with application-specific tools, floating palettes, and menu commands. Sep 93

★★★★ **Sketcher, Fractal Design Corp.**, 408/688-8800, \$149. A variety of effects reproduce techniques of traditional drawing tools with this wonderful gray-scale paint and image processing program. Feb 93

★★ **StrataType 3d 1.0 (2.0)**, Strata, 801/628-5218, \$199. The rulers, texture palette, custom bevels, and canned positioning schemes of this 3-D type-effects software are nice, but they can't compare with the animation skills, lighting capabilities, and superb rendering of other available programs. Mar 93

★★★ **Transverter Pro 1.0, TechPool**, 216/291-1922, \$395. Remarkable graphics-conversion software can read PostScript files and convert them to a variety of formats. As you might expect of a program attempting to fill such a tall order, its conversions are not always flawless, but it can be a lifesaver nonetheless. Nov 93

★★★ **Tree, Onyx Computing**, 617/876-3876, \$295. Single-purpose program generates lifelike color drawings of trees from a number of easily controlled parameters. Although visually appealing, it's an expensive way to draw a tree. May 93

★★★ **upFront 2.0, Alias Research**, 416/362-9181, \$299. Capable modeler is something of an acquired taste. However, take the time to learn it and you'll find useful, if unconventional and demanding, tools that are well suited for architectural modeling. Jan 94

★★★ **Virtus WalkThrough 1.1.3, Virtus Corp.**, 919/467-9700, \$495. Interactive 3-D modeling tool provides instantaneous access to rendered 3-D scenes, allowing you to travel through models at will. While it has some problems (such as occasionally just quitting), it's an excellent value. Jul 93

★★★ **Wraptures One, Wraptures Two, Form and Function**, 619/536-9999, \$95 each. The images in these texture collections on CD-ROM are generally acceptable, although some are muddy and others are difficult to decipher at low resolutions. If you need images for repeating patterns, however, these repeat seamlessly and are a good value. Aug 93

MATH/SCIENCE

★★★★ **Alchemy III, Tripos Associates**, 314/647-1099, \$950. Molecular-modeling software can model decapeptides and DNA fragments, in addition to the expected small molecules, with refreshing alacrity on a Mac IICI or better. Sep 93

★★★★ **Amazing Universe 2.1, Hopkins Technology**, 612/931-9376, \$79.95. Space-image exploration package on CD-ROM offers an amazing variety of astronomical images with a very competent program (ProVision II) for modifying and inspecting those images. It assumes that users won't be fazed by such things as writing their own image-convolution matrices. Aug 93

★★★★ **CircuitMaker 3.0, MicroCode Engineering**, 801/226-4470, \$200. Much of the tedium of diagramming circuits and constructing prototypes is relieved by this digital circuit simulator that provides a powerful set of basic tools for a very reasonable price. Aug 93

★★★★ **Data Desk 4.0 (4.1), Data Description**, 607/257-1000, \$595. For finding patterns in data, this statistical-analysis program has no peer. Years of refinement have made it a uniquely valuable tool, despite its lack of some tests found in larger programs. May 93

★★★★ **Expressionist 3.0 (3.01), Prescience Corp.**, 415/543-2252, \$199.95. If you work regularly on similar topics, you can customize this equation-writing software to produce equations with exactly the appearance you want, letting you work at amazing speed. Mar 93

★★★★ **f(z) 6, Lascaux Graphics**, 602/299-0661, \$115. The main problem this math software attacks is four-dimensional visualization. It costs slightly more than a textbook, making it a great educational bargain. Sep 93

★★★ **FASTAT 2.0, SYSTAT**, 708/864-5670, \$495. Statistical business-analysis software makes sense as a day-to-day statistics tool. It provides the right tests for most requirements, and its graph types provide plenty of information, although they lack glamour. Jun 93

★★★★ **HiQ 2.0, Bimillennium Corp.**, 408/354-7511, \$995. The three great strengths of this numerical mathematics software are its fast differential-equation-solving section, its excellent matrix-math capabilities, and its natural notebook-format interface. Sep 93

★★★ **InStat 2.01, GraphPad Software**, 619/457-3909, \$95. For scientists with limited statistics backgrounds, the chatty clarity of this lab-oriented statistics software's help screens will be invaluable, while the limited variables and minimal graphics won't be a problem. Nov 93

★★★ **LabTutor 2.0, J. K. Eaton**, 415/723-1971, \$50. Tutorial on laboratory computer-interfacing provides a detailed, thorough exposition of computer interfacing in general, but it requires LabView and a National Instruments interface board for its exercises. Sep 93

★★★★ **MacPhase 1.2, Otter Solutions**, 315/768-3956, \$159. Low-cost, scientific-data-visualization software with an assortment of mathematical tools is an authentic bargain. A principal strength is a well-planned color lookup table editor that's delightfully easy to use. May 93

★★★★ **MathCAD 3.1, MathSoft**, 617/577-1017, \$495. Numerical and symbolic computation software is easy to learn and use, and it is much more powerful than earlier versions. It does not compete in scope with the largest mathematics programs, but for most science and engineering tasks, it is a quick way to get problems solved. Jun 93

★★★★ **Mathematica 2.2, Wolfram Research**, 217/398-0700, \$595. The one essential program in science and mathematics adds a function browser that makes the program as easy to use as it should be, as well as improvements to computational routines. Sep 93

★★★★ **MathType 3.0, Design Science**, 310/433-0685, \$199. This equation-writing software makes automatic typographical decisions, which is helpful if you produce documents on a wide range of subjects. Its smooth integration with Microsoft Word is also convenient. Mar 93

★★★★ **QC Tools 1.0, Abacus Concepts**, 510/540-1949, \$245. Quality-control tool kit for StatView appears to introduce a slight slowdown in program response, but is generally well designed, well documented,

and suitable for quality-control neophytes as well as professionals. Jan 94

★★★★ **Spyglass Dicer 2.0, Spyglass**, 217/355-6000, \$695. Scientific 3-D visualization tool displays a two-dimensional slice through a three-dimensional object (which is represented in the computer by a data table). While Dicer pushes the limits of the Mac hardware, for its function this product is really the only game in town. Jul 93

★★★ **Spyglass Transform 3.0, Spyglass**, 217/355-6000, \$595. Scientific-visualization software can access data stored in every common format, offers some useful presentation-graphics features, and includes a programming language with a large range of built-in, high-level scientific functions. Sep 93

★★★★ **StatView 4.01, Abacus Concepts**, 510/540-1949, \$595. If your work uses statistics for decision support rather than abstract analysis, and you regularly have to present your results to nonstatisticians, this is the statistics package for you. Oct 93

★★★ **Sum Total 1.01, Concurrent Engineering Tools**, 602/464-8208, \$99.95. Exceptional calculator utility is packed with advanced features, including a mode that lets you sample colors and use the numerical color values in calculations. The convenient palette approach causes a distinct time-lag in menu operations. Oct 93

★★★★ **Theorist 1.5, Prescience Corp.**, 415/543-2252, \$449.95. Symbolic-math program that you can figure out by yourself adds a useful table feature, more special functions of physics, and better graphics. It's still the only program to use real notation directly. May 93

★★★★ **Visualization of Natural Phenomena, Telos/Springer Verlag**, 408/249-9314, \$59.95. CD-ROM introduction to applying all aspects of computer graphics to scientific imaging; covers all disciplines and offers definitive analysis of methods. No other source covers this much material, at this level of clarity. Jan 94

★★★★ **Voyager II, Carina Software**, 510/352-7328, \$159.95. If a brilliantly lit, star-filled sky holds more than a moment's fascination for you, you need to know about this astronomy program. In a firmament of mostly faint and forgettable astronomy software, it's a supernova. Jul 93

ORGANIZATION/PRODUCTIVITY

★★★ **Achieving Your Career 1.02, Up Software**, 415/921-4691, \$69. HyperCard-based job-search software succeeds by compactly organizing. It provides a structure for identifying letters to write, phone calls to make, and interviews to follow up. Aug 93

★★ **ACT 1.0 (1.01), Contact Software International**, 214/919-9500, \$395. While this contact manager has several laudable features, such as customizable contact views and an integrated word processor, learning how to use it is a frustrating experience. Feb 93

★★★★ **CalendarMaker 4.0, CE Software**, 515/224-1995, \$59.95. Polished, intuitive calendar-making program is straightforward, with a variety of options for customizing your calendar. Some features can be cumbersome. Oct 93

★★ **ClientTrac 1.7.1, Whiskey Hill Software**, 415/851-8702, \$135. Easy-to-use, HyperCard-based contact-management software performs as billed, but fails to inspire much enthusiasm. Aug 93

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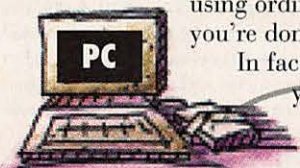
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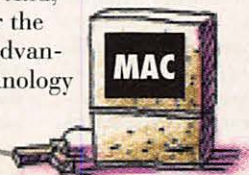
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MAC WORLD

Star Ratings

★★★ **Contact Ease 2.0.1, WestWare, 619/660-0356, \$395 to \$1495.** Contact-management and sales-automation software helps salespeople keep in touch with contacts, makes it easy to generate letters, and maintains detailed records of activities. It has a few quirks but is overall a good program. Aug 93

★★★★ **DateBook 1.5.1 (1.5.li), After Hours Software, 818/780-2220, \$125.** Personal time manager offers a flexible approach to event scheduling and to-do-list management. This upgrade adds new features and fixes bugs that plagued the first version. Feb 93

★★★★ **DayMaker 2.0 (2.03), Pastel Development Corp., 212/941-7500, \$129.95.** If you need to organize lots of disparate information, follow up on meetings with many people, create an archive of completed work, and print out lists of to-do items, this free-form personal information manager is a great choice. May 93

★★★★ **Dynodex 3.0, Portfolio Software, 408/252-0420, \$89.95.** The speed and printing options of this field-based address-book manager are its strengths, but this upgrade adds welcome improvements to the interface, including automatic formatting of phone numbers. Apr 93

★★★★ **In Control 2.0, Attain Corp., 617/776-1110, \$129.95.** The best features of an outlining program are combined with those of a database, making it easy to sort, search, organize, and print your to-do list. Aug 93

★★★★ **Inspiration 4.0, Inspiration Software, 503/245-9011, \$295.** Watch your ideas evolve in a dynamic diagram mode and a text-based outline mode with this brainstorming tool. Feb 93

★★★★ **Intouch 2.0.4, Advanced Software, 408/733-0745, \$99.95.** Free-form database is a fast and easy way to manage contact information. Although this version adds a handy reminder system, it falls short as a calendar planner. Feb 93

★★★ **LapTrack For the Mac 1.0b, Timeslips Corp., 508/768-6100, \$79.95.** Time- and expense-tracking program offers the right features for the on-the-go professional, but the interface is overcomplicated and the documentation is sloppy. Still, in spite of its flaws, it does an excellent job. May 93

★★★★ **Now Up-to-Date 2.0, Now Software, 503/274-2800, \$99 to \$799.** Calendar utility combines flexibility, ease-of-use, and streamlined operations in an almost irresistible package. The Reminder control panel, while a great new feature, has had minor conflicts. Jun 93

★★★★ **Power Team 1.0, ProVue Development Corp., 714/892-8199, \$149.95.** Personal information manager consists of seven modules: Phone Book, Calendar, Correspondence, Checkbook, Calculator, Expense Report, and Mailing List. It has some bugs, but the data entry features are excellent. Oct 93

★★ **Rae Assist 1.0.2, Rae Technology, 408/725-2850, \$199.** This personal information manager offers some fresh ideas, like automatic linking of company and contact info, but it's too big and slow. Jan 94

★★★★ **Spiral 1.0 (1.02), Technology Works, 512/794-8533, \$129.** Designed specifically for taking and organizing notes, this product has an excellent feature set, but it's marred by some errors in the editing and import/export processes. Mar 93

★★ **TimeVision 1.0, Powercore, 815/468-3737, \$99.** New scheduler with notepad and card-file functions tacked on has some worthwhile features, but in general doesn't match up to the competition. May 93

PRESENTATION TOOLS

★★★★ **Action 1.0 (1.02), Macromedia, 415/252-2000, \$495.** Entry-level multimedia integration program offers, for its price, a rich selection of features, including a variety of transitions as well as gradient and patterned backgrounds. Feb 93

★★★★ **Adobe Premiere 3.0, Adobe Systems, 415/961-4400, \$695.** Solid and dependable QuickTime video-editing software offers a structured, responsive, and flexible interface with enhancements that range from mundane to dramatic. It can now mix 99 tracks. Jan 94

★★★★ **Astound 1.0, Gold Disk, 408/982-0200, \$399.** Presentation software lets you include sound, text, and graphics animation with no more effort than pasting in a chart in other products. It's a good value. Nov 93

★★ **Comet CG 1.0.3, MSI, 317/842-5097, \$995.** Program for generating antialiased text over live video is reasonably priced compared with dedicated graphics systems, but you're likely to be as astonished by its limitations as you are impressed by its capabilities. May 93

★★★★ **CoSA After Effects 1.1, CoSA, 401/831-2672, \$1295.** QuickTime movie editor blurs the boundaries between animation and traditional video-editing. It produces results that simply can't be created in other packages. Oct 93

★★★ **Hi Rez Audio Volume 1.0, Presto Studios, 619/689-4895, \$149.95.** The enjoyable, high-quality music on this CD-ROM adds a nice touch to presentations. The software for browsing the music is quirky, and the product could use some documentation. Jul 93

★★★★ **Interactive Training for Director 1.1, Media In Motion, 415/621-0707, \$199.** This somewhat expensive program teaches basic Macromedia Director skills and provides a foundation for exploring Director's other features. It has a clear, often lighthearted approach, but navigating the lessons can be frustrating. Jun 93

★★★★ **Macromedia Director 3.1 (3.1.1), Macromedia, 415/252-2000, \$1195.** Versatile multimedia authoring tool adds 23 scripting commands, QuickTime, and a utility that compiles movies into a faster playback format—along with a whopping \$149 addition to the price. Feb 93

★★★★ **Media-Pedia Video Clips, Media-Pedia, 617/235-5617, \$195 to \$495.** Fifty-seven minutes of stock footage for use in QuickTime movies includes over 150 different segments, ranging from unremarkable to dramatic to genuinely funny. Apr 93

★★★★ **Microsoft PowerPoint 3.0, Microsoft, 206/882-8080, \$495.** This presentation program is ahead of the pack in terms of convenience and ease of use. Although the ready-made template collection is pretty paltry, the extensive system of master layers, reliable cross-platform compatibility, and strong on-screen presentation capabilities more than compensate. Feb 93

★★ **MovieWorks 1.1, Interactive Solutions, 415/377-0136, \$395.** Over 100 bugs were fixed in version 1.1 of this multimedia authoring software that takes an all-in-one approach to creating presentations, but problems remain. It's a good idea, poorly executed. Jun 93

★★★★ **Passport Producer 1.0, Passport Designs, 415/726-0280, \$495.** Strong timing controls and good sound capabilities mix with middling text- and image-handling and a lack of basic animation options in this partially successful multimedia program. Apr 93

★★★★ **Special Delivery 1.0 (1.1), Interactive Media Corp., 415/948-0745, \$399.** While this entry-level multimedia package has all the tools you need to assemble interactive screen presentations that burst with motion and sound, it has a disorienting interface and lacks the polish and power of other programs. Mar 93

★★★★ **VideoFusion 1.0.1, VideoFusion, 419/891-1090, \$649.** Collection of special effects for QuickTime movies may not be for the casual user, but if you have the equipment and you can't live without spinning logos, then go ahead and indulge. Jul 93

★★★★ **Working Model 1.0, Knowledge Revolution, 415/553-8153, \$995.** Animators and engineers will love this terrific motion simulator that mimics real motion by applying physical laws to objects. It's easy to learn and use, but you'll need some understanding of math and physics. Oct 93

PROGRAMMING

★★★★ **CLimate 1.0, Orchard Software, 617/876-4608, \$59.95.** With a little more documentation and a few more sample programs, this utility that provides a subset of Unix-like commands for the Mac environment could be an irresistible package. Oct 93

★★★★ **EISToolKit 2.0, MicroStrategy, 302/427-8800, \$1995.** Reliable, field-tested developer's environment for creating executive information systems provides automatic access to information in spreadsheets and databases across a distributed system. May 93

★★★★ **FutureBASIC 1.0, Zedcor, 602/881-8101, \$299.95.** Complete, easy-to-learn, real-world programming tool has full Toolbox, System 7, and assembler support. It's a wonderful tool that's rapidly becoming a favorite among commercial developers. Jul 93

★★★★ **Macintosh Common Lisp 2.0, APDA, 716/871-6555, \$495.** Anyone who likes programming in LISP will be pleased with the environment provided by this version of the standard dialect and its extensive debugging and interface-building facilities. Oct 93

★★★★ **MetaDesign for the Macintosh 3.0, Meta Software Corp., 617/576-6920, \$250.** This diagramming tool for structured systems analysis offers easy ways to group and ungroup symbols in diagrams and to show relationships between symbols. It excels at austere, classic flowcharts but could use some flashier features, such as shaded backgrounds, for presentations. Mar 93

★★★★ **Object Logo Student Edition, Paradigm Software, 617/576-7675, \$49.95.** This book-plus-disk package offers a wide-ranging introduction to programming concepts. It's aimed roughly at the high-school educational level and lets you see something happen for every few lines of code you type. Jul 93

★★★★ **PG:Pro 1.5, Staz Software, 601/255-7085, \$169.** For part-time or novice programmers, the combination of these BASIC programming tools and FutureBASIC is a fast path to a working program. Jul 93

★★★★ **PowerPacks 2.0, NDG Phoenix, 301/718-8880, \$225.** Programmers' tool kit for 4th Dimension provides 280 external procedures to improve custom applications and exploit System 7 features. Don't expect any quick fixes for 4D's less-than-blistering performance in most areas, though. Oct 93

★★★★ **SoftPolish 1.1, Language Systems Corp., continues**



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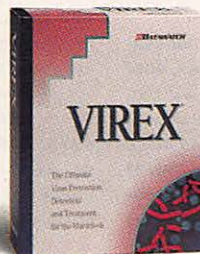
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*In a head-to-head test conducted on a Macintosh IIfx, scanning 79 megabytes of files (1,571 files) on a 230 megabyte hard drive. Results may vary but, in all tests, Virex was dramatically faster.
[†]SAM is a registered trademark of Symantec Corporation.

Circle 37 on reader service card

Star Ratings

703/478-0181, \$295. Program-quality-assurance utility systematically checks the resources in a program's interface against a huge laundry list of errors. It's a programming tool for anyone who hopes to produce a commercial Mac application. Sep 93

★★★★ **SourceSafe 2.1, One Tree Software, 919/821-2300, \$295 to \$1195.** Solid, relatively easy-to-use product handles program-development administrative tasks, including version control, for multiplatform programs being created by groups. Sep 93

★★★★ **Symantec C++ for Macintosh 6.0, Symantec Corp., 408/253-9600, \$499.** If you like Think C, you'll like this software-development system, too. For the Mac, it's an excellent opportunity to catch a new wave in programming. Nov 93

UTILITIES

★★★★ **7th Heaven 2.5, Logical Solutions, 612/659-2495, \$99.95.** Our reviewer found the seven enhancements to System 7 fun and elegantly done, but not all of them were useful. Jul 93

★★★★ **Alki Seek 2.1, Alki Software Corp., 206/286-2600, \$39.95.** Competent file-finding utility scans by file name or content and lets you combine multiple search criteria. It cannot search in the background or find text in compressed files. Jul 93

★★★★ **At Ease 1.0 (1.1), Apple Computer, 408/996-1010, \$59.** Sweet, simple, secure substitute for the Finder displays a clean, attractive page full of over-size icons where a single click launches a program or document. To delete, rename, or move files, you have to return to the Finder. Mar 93

★★★★ **Billy Steinberg's PBTools 1.0.1, Inline Design, 203/435-4995, \$99.95.** If you want basic PowerBook management without added frills or complex menu bar displays, this collection of four utilities may be just your cup of tea. Jul 93

★★★★ **Chameleon 2.0.3, Logical Solutions, 612/659-2495, \$59.95.** Sleek desktop-pattern editor comes with an ample supply of rich, textured color images and a set of limited but functional editing tools. Sep 93

★★★★ **ClickChange 2.0, Dubl-Click Software, 818/888-2068, \$89.95.** Interface-customizing package has nothing you need but is filled with everything you want, including tools that let you alter major elements of the Mac's look-and-feel. Aug 93

★★★★ **Conflict Catcher and Other Innovative Utilities 1.0 (1.3.8), Casady & Greene, 408/484-9228, \$79.95.** Enable or disable INITs and start-up items when you boot, with this INIT manager that comes with four other system-related utilities. It's a worthwhile investment even if you own another INIT manager. Mar 93

★★★★ **Connectix Desktop Utilities 1.0, Connectix Corp., 415/571-5100, \$99.** Although some of the 16 utilities offered in this package are more at home on a PowerBook, this collection offers one-stop shopping at a low price. It's worth it for the file-synchronization, Keyboard Power and Hot Keys features alone. Nov 93

★★★★ **CopyDoublor 2.0 (2.0.1), Fifth Generation Systems, 504/291-7221, \$59.** This utility speeds up copying, lets you queue jobs for background copying, and offers a variety of other useful, copying-oriented features—all at a very reasonable price. Nov 93

★★★★ **Copyright Pro 1.0.3, CSG Technologies,**

412/471-7170, \$79. Utility takes over the Finder's copying function, copies in the background, and allows you to regularly schedule copying. It doesn't speed up copying, however. Nov 93

★★★★ **CPU 2.0, Connectix Corp., 415/571-5100, \$99.** Reasonably priced collection of utilities for the PowerBook adds new features, including file synchronization, that easily justify the upgrade price. Sep 93

★★★★ **DiskFit Direct 1.0, Dantz Development Corp., 510/849-0293, \$49.95.** Basic but efficient backup system is simple and painless enough to foster better backup habits in anyone who uses it. It doesn't back up to hard drives or tape drives. May 93

★★★★ **DiskLock PB 1.0, Symantec/Fifth Generation Systems, 504/291-7221, \$59.** PowerBook security software balances robust security with simplicity and ease of use. It's much harder to crack than most PowerBook utility collections' security features, and will keep out all but the most determined. Jan 94

★★★★ **DriveShare 1.03, Casa Blanca Works, 415/461-2227, \$149.95.** Utility allows users to share a removable drive over a network. It's most useful if your network consists of both System 6 and System 7 users, as its advantages over System 7 file sharing are slight. Nov 93

★ **DriveTech 1.0, MicroMat Computer Systems, 415/898-6227, \$59.95.** Without decent documentation or clearer error messages, this floppy drive cleaning and diagnostic program is essentially a \$60 floppy drive cleaning kit. Since you can buy a cleaning kit without software for \$10, that makes it a bad deal. Jan 94

★★★★ **DupLocator 1.03, Midnight Software, 303/933-1013, \$99.** For new Macintosh users who don't have a general file utility, this software that locates duplicate files, as well as performs basic file commands such as moving and renaming files, may be useful. Jan 94

★★ **DynoPage 2.0, Portfolio Software, 408/252-0420, \$89.95.** While this utility simplifies the printing of booklets and double-sided pages, it doesn't support PostScript graphics, is incompatible with some popular applications, and has a buggy drag-and-drop feature. Jul 93

★ **eDisk 1.0, Alysis Software Corp., 415/566-2263, \$149.95.** Driver-level compression software has little to recommend it over file-level, idle-time compression programs. The biggest drawback is the strong potential for disk or file corruption. Oct 93

★★★★ **I Like Icon, Baseline Publishing, 901/682-9676, \$59.95.** Glitzy utility has tools for icon editing, has a nice library of icons, and can create animated icons. Some basic features, such as a text tool, are missing, and the animated icons are fun but impractical. Sep 93

★★★★ **Icon 7 (1.1), Inline Design, 203/435-4995, \$79.95.** Simple, straightforward utility has a streamlined and intuitive library feature for storing and retrieving icons, plus tools for icon editing. Its icon collection, however, is pretty paltry. Sep 93

★★★★ **Icon-It Pro 3.0.6, Olduvai Corp., 305/670-1112, \$129.** Utility allows you to attach custom tool bars to almost any application, including the Finder. The interface is quirky, but you get used to it. Dec 93

★★★★ **INITPicker 3.0 (3.02), Inline Design, 203/435-4995, \$79.95.** This INIT manager's ability to load aliased INITs over a network will interest network managers. While it disables problem INITs at start-up, it doesn't help you identify the cause of INIT conflicts that don't cause the Mac to crash at start-up. Mar 93

★★★★ **Inline Sync 1.0 (1.01), Inline Design, 203/435-4995, \$129.95.** Keep the latest version of your work on your portable machine and your desktop Mac with this file-sync software. It's easy to install, easy to use, easy on the wallet, and does the job well. Mar 93

★★★★ **KidDesk 1.0, Edmark Corp., 206/556-8484, \$39.95.** If you have young children who love to experiment with your Mac, this desktop environment provides easily navigable play while protecting your files from the havoc that little fingers can wreak. Jun 93

★★★★ **MacPak 1.0, Symantec/Fifth Generation Systems, 504/291-7221, \$149.** The quality of this utility collection is uneven—some modules are unpolished—but if you don't already own AutoDoubler, CopyDoubler, and a good file-management program, it's worth the price. Jan 94

★★ **Magic Typist 2.0, Olduvai Corp., 305/670-1112, \$129.** If you want to speed up typing of repetitive phrases or if you don't have full use of your hands, this utility, which automates typing of repetitive phrases, may be useful, but some functions work erratically or not at all in Microsoft Word. Sep 93

★★★★ **Magnet 1.0 (1.01), No Hands Software, 415/321-7340, \$129.95.** Automation aids file management with this software. It creates "magnets" that trigger in response to user-specified events and automatically look for files to copy, move, or alias. Feb 93

★★★★ **Mr. File 2.0, Softways, 408/978-9167, \$99.** The well-designed background capabilities of this Finder utility make it a handy tool for copying, finding, moving, launching, and renaming files, although it has a few interface quirks. Dec 93

★★★★ **Norton Essentials for PowerBook 1.0, Symantec Corp., 310/453-4600, \$129.** Uneven collection of PowerBook utilities ranges from the useful Instant Access module, which automatically turns AppleTalk on and off, to the relatively inaccurate Battery Gauge feature, which tries to tell you your battery's status. Apr 93

★★★★ **Now Compress 1.0, Now Software, 503/274-2800, \$99.** Compression utility holds its own in a crowded market; it's easy to use, it's complete, and it compresses as well as or better than other options. Dec 93

★★★★ **Now Fun, Now Software, 503/274-2800, \$69.** Five control panels let you liven up your Mac by customizing everything from menu colors to system sounds. The included screen-saver modules and desktop patterns and pictures are fairly limited, though. Dec 93

★★★★ **Now Utilities 4.0.1, Now Software, 503/274-2800, \$129.** Many thoughtful improvements have been added to this collection of utilities, which is now better integrated, more logically designed, and still an excellent deal for your dollar. The new scrapbook feature, however, is awkward and inconvenient. Aug 93

★★★★ **Peace of Mind 1.2.2, Polybus Systems Corp., 716/871-6533, \$149.** Hardware diagnostic tool performs exhaustive tests on major Mac hardware components; does an excellent job of diagnosing simple simulated hardware errors. The program has minor bugs and lacks a comparative test-history feature. Jun 93

★★★★ **PicturePress 2.5, Storm Technology, 415/691-6600, \$199.** This image-compression software supports every useful storage mode, has new calculation features for improved image fidelity, and is twice as fast as version 2.0. Mar 93

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★★★ **Power To Go 2.0**, Claris Corp., 408/727-8227, \$99. PowerBook utility collection has a few unique slants—including a floating palette that can display battery-life estimates—that keep it above the also-rans. It does lack features of similar products. Dec 93

★★★ **PowerMerge 1.0.2**, Leader Technologies, 714/757-1787, \$129. File-synchronization utility has a potentially confusing interface, but is a handy means of updating selected files so that different Macs end up with identical versions of the selected documents. Apr 93

★★★ **Public Utilities for the Macintosh 1.0**, Fifth Generation Systems, 504/291-7221, \$149. Utility program sticks to the basics of disk diagnosis, disk repair, and file optimization. It does a good, and in some cases unique, job, although disk optimization is slow. Fifth Generation's technical support is excellent. Jun 93

★★★ **RapidTrak 1.0.1**, Insignia Solutions, 415/694-7600, \$99.95. If you've got RAM to spare, this hard drive formatter offers driver-level RAM caching to store frequently used data and improve performance, especially on slower-speed drives. May 93

★★★ **Redux Deluxe 2.0.2**, Inline Software, 203/435-4995, \$79.95. Easy to learn and relatively simple to use, this backup program has some powerful features, such as scripting, but it doesn't have a compression option. Jan 94

★★★★ **Retrospect 2.0**, Dantz Development Corp., 510/849-0293, \$249. Powerful backup and archiving software has an improved interface and scripting capabilities, and works well for all levels of users. Sep 93

★★★★ **Retrospect Remote 2.0**, Dantz Development Corp., 510/849-0293, \$449. Utility allows fast, automatic backup of networked Macs to a central Mac with a backup device. It worked flawlessly in our reviewer's tests. Sep 93

★★★ **Safe and Sound**, Central Point Software, 503/690-8090, \$49.95. Limited but useful disk-protection and -salvage utility has a clean, simple interface and is an efficient emergency recovery tool. Jun 93

★★ **Safe or Sorry 1.0**, Olduvai Corp., 305/670-1112, \$59. Unobtrusive control panel periodically saves all of your keystrokes, but requires System 7.1 and offers no clear-cut advantages when compared with other text-recovery programs. Oct 93

★★ **SafeDeposit 1.2**, Dayna Communications, 801/269-7200, \$189. Automated backup program is easy to set up but slow. Also, unattended backups must be restarted from scratch if disk space runs short and a new disk isn't inserted. Sep 93

★★★★ **Screenscapes 1.0.1**, Kiwi Software, 805/685-4031, \$44.95. With more than 600 desktop patterns—and a suite of well-designed modules to transform those patterns—this fun and frivolous utility lifts desktop-pattern design to new heights of elegance. Nov 93

★★★ **Square One 1.5.2**, Binary Software, 310/582-8293, \$74. Flexible, attractive icon-based file launcher provides infinitely customizable palettes, including one that displays active applications. The application will consume 400K of your system memory. Aug 93

★★ **Stacker for the Macintosh 1.0.1**, Stac Electronics, 619/431-7474, \$149. As long as you pay attention to the capacity of your hard drive, this driver-level compression product performs reasonably well, except for its slow hard drive read quotient. Oct 93

★★★★ **Star Trek: The Screen Saver**, Berke-

ley Systems, 510/540-5535, \$59.95. Go where no Mac has gone before with this screen saver based on the original "Star Trek." May 93

★★★★ **Star Wars Visual Clips, Sound Source Unlimited**, 805/494-9996, \$89.95. Control panel lets you play QuickTime movie clips from *Star Wars* at system events. If you have the money, the hard drive space, and the RAM, this is the kind of totally cool toy that will make you remember why you love your Mac. Sep 93

★★★★ **Stuffit Deluxe with SpaceSaver 3.0**, Aladdin Systems, 408/761-6200, \$120. Its many conversion tools, automatic compression capabilities, reliability checks, and acceptable performance make this product the jack-of-all-trades of compression utilities. Aug 93

★★★ **Super 7 Utilities**, Atticus Software, 203/324-1142, \$99.95. Collection of seven control panels/extensions adds some ease of use to System 7, although none of its functions are essential. Modules perform tricks such as turning any menu into a tear-off palette, and randomizing the sounds that play in response to errors. Apr 93

★★ **TimesTwo 1.0.1**, Golden Triangle Computers, 619/279-2100, \$149. Automatic disk-compression utility operates at the disk-driver level. A number of quirks, such as its ungraceful handling of full disks, are problems. May 93

★★★★ **Toner Tuner 1.0.3**, Working Software, 408/423-5696, \$24.95. Inexpensive, incredibly useful extension adds a sliding bar to print dialog boxes allowing you to adjust the amount of toner applied to each print job. If you can't save trees, you can at least save toner. Dec 93

★★★★ **ultraShield 1.252**, usrE2 Software, 714/756-5140, \$149. Sophisticated security product combines practically every feature you might need into an integrated package, including a lightning-fast version of the U.S. government data-encryption standard. Dec 93

★★★ **Virtual 3.0.1**, Connectix Corp., 415/571-5100, \$99. If you need to eke out as much virtual memory speed as possible, this utility may be a useful tool. For System 6 users who want virtual memory, it's the only game in town. Sep 93

★★★ **Working Watermarker 1.02**, Working Software, 408/423-5696, \$49.95. Simple, useful system extension allows you to print or fax text and/or graphics "watermarks" in the background of virtually any document. Although it has imperfections, it's earned a permanent spot in our reviewer's System Folder. Jan 94

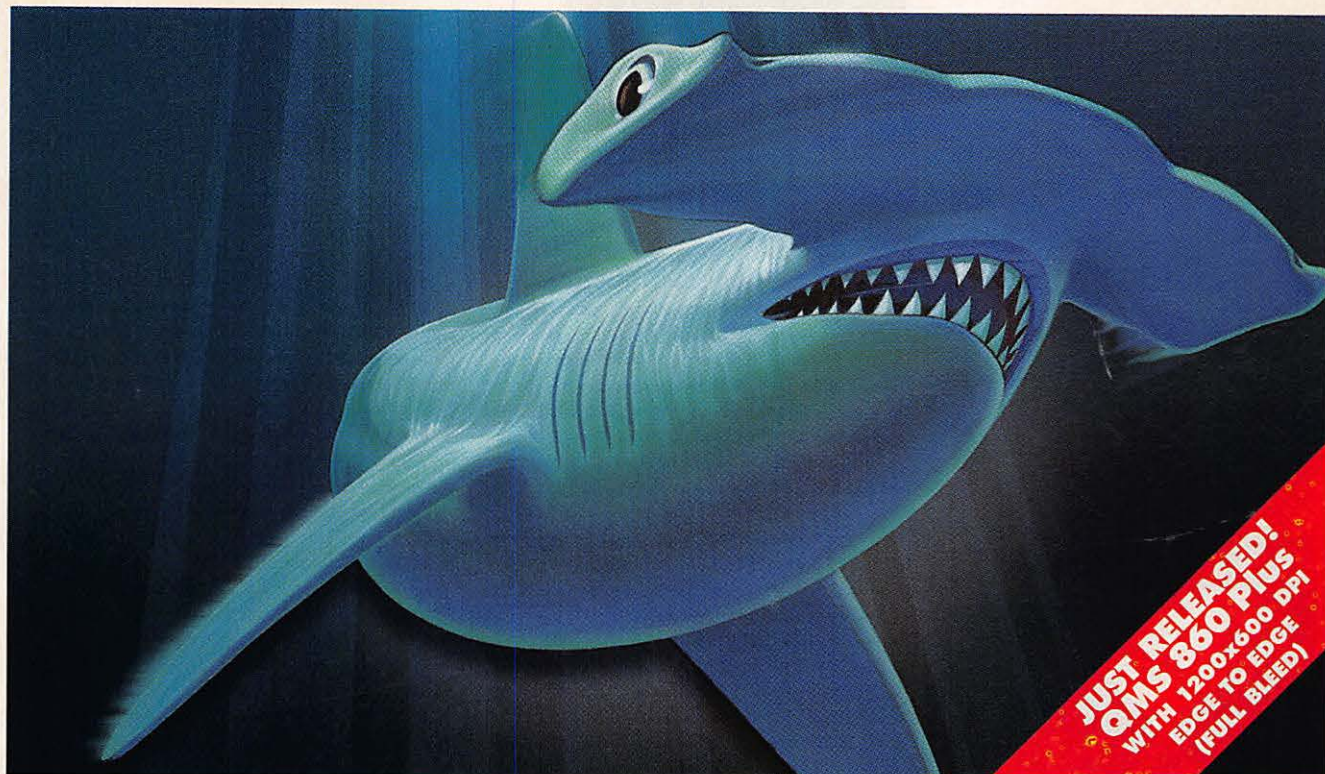
VERTICAL MARKETS

★★★ **Compare-A-Loan 4.0.2 (4.1)**, Softflair, 612/894-3357, \$79.95. Although geared to professionals, this product for home-loan evaluation provides thorough documentation and is structured so that anyone can use it. Apr 93

★★★ **Expert Home Design 1.0 (1.0.3)**, Expert Software, 305/567-9990, \$49.95. Quickly and easily create home- or office-interior layouts that are precise, but not as detailed as blueprints, with this interior design software. May 93

★★ **Expert Landscape Design 1.0 (1.0.2)**, Expert Software, 305/567-9990, \$49.95. Bare-bones drawing environment for experimenting with landscape design is inexpensive, but its usefulness is severely limited because of awkward color and pattern tools. Feb 93

continues



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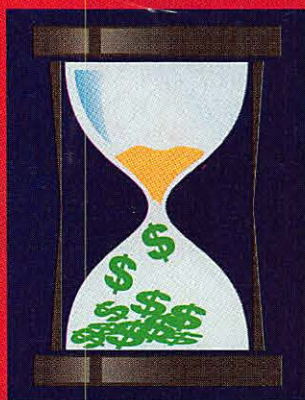
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★★★★ **Finale 3.0.1**, Coda Music Technology, 800/843-2066, \$749. Upgraded music-notation software is now infinitely more pleasant to use. Its comprehensive feature set makes it the standard against which all other music-notation products must be judged. Dec 93

★★★ **LoanLease Library 3.0.3 (3.05)**, Softflair, 612/894-3357, \$99.95. If you are generating a loan or a lease and need to keep track of payments, this well-documented program for loan evaluation is a worthwhile investment, despite its minor eccentricities. Apr 93

★★★★ **Musicshop 1.0**, Opcode Systems, 415/856-3333, \$149.95. MIDI sequencer is an excellent choice as a first sequencer. It's powerful enough to satisfy the needs of most MIDI users. Oct 93

★★★ **Roll Call 2.0**, By the Numbers, 603/927-4508, \$495. 4th Dimension database application for church management helps track donations, attendance, church-group membership, and visitation. While not a complete church-management system, it's an acceptable complement to a general accounting program. Aug 93

★★★ **Sailing Master 1.1**, Starboard Software, 313/662-4393, \$64.99. Though the slow speed and jerky motion point to less-than-polished programming, this sailboat-racing simulation offers good tactical play and is fun—well worth the price for sailing competitors. Nov 93

WRITING TOOLS

★★★★ **Final Draft 2.0 (2.0.3)**, MacToolkit, 310/395-4242, \$349. Script-writing gets simpler with this well-conceived software that automates formatting of different elements in a script. Customization is easy, and macros automate typing of common phrases. Apr 93

★★★ **Just Joking 1.0**, WordStar International, 415/382-8000, \$49. HyperCard stack of around 2800 humorous quotations offers a serviceable selection of sayings from a diverse group of humorists, comedians, philosophers, and writers, among others. Apr 93

★★★★ **MacWrite Pro**, Claris Corp., 408/987-7000, \$249. Many of the new features of this upgrade are very well executed, including the easy-to-use table feature, simple but elegant palettes, and an almost pain-free mail merge feature. Jul 93

★★ **MasterWord 5.1**, Alki Software Corp., 206/286-2600, \$99.95. The centerpiece of this package of add-on Microsoft Word commands is a set of customizable tool bars. Unfortunately, rough edges remain, including inaccuracies in the documentation and some features that don't work as advertised. Aug 93

★★★★ **Microsoft Word 5.1**, Microsoft, 206/882-8080, \$495. Small, solid upgrade fine-tunes some plug-in modules and adds new modules including an icon tool bar and text annotation. It's worth the upgrade price, but it won't give Word 5.0 users goosebumps. Mar 93

★★★ **RightWriter for the Mac 5.0**, Que Software, 317/573-2500, \$99.95. Grammar checker looks at writing style, word usage, punctuation, and capitalization, as well as grammar. Customizable filters and multiple approaches to analysis are nice, but—as with all grammar checkers—not all the advice is great. May 93

★★★ **ShowScape 4.1**, Lake Compuframes, 914/941-1998, \$429 to \$679. This script-writing software formats scripts in either screenplay format or dual-column format (for audio and video) and allows you to choose the number of shots displayed per page, but it re-

quires you to own and work in WordPerfect. Apr 93

★★★ **Spelling Coach Professional 4.0.1**, Deneba Software, 305/596-5644, \$195. If you're considering investing in reference software, this spelling checker, dictionary, and thesaurus is a relatively capable, if expensive, alternative. Oct 93

★★★★ **Thunder 7 1.5.3**, Baseline Publishing, 901/682-9676, \$99.95. Stand-alone spelling checker and thesaurus interactively monitors your keystrokes and alerts you to potential errors as they are entered. It quickly and transparently prevents you from making embarrassing typos. Nov 93

★★★ **TypeReader 1.0**, ExperVision, 408/428-9988, \$695. Speed and accuracy combine with a straightforward operating style in this high-end OCR software that doesn't do everything its competition does, but is a major contender nonetheless. Feb 93

★★★ **VersionMaster 1.5**, AStar Technologies, 508/486-8532, \$199.95 to \$1199.95. Document-management utility helps you archive and track versions of a file by maintaining a database of altered documents. It's recommended only for workgroups that routinely follow check-out procedures. Apr 93

★★★ **A Zillion Kajillion Rhymes 1.0**, Eccentric Software, 206/628-2687, \$49.95. Rhyming dictionary is quick, small, simple, and self-contained; but it only rhymes with the roots of search words (and ignores -ed, -s, and -ing endings). Nov 93

Hardware

MISCELLANEOUS HARDWARE

★★ **ACS100**, Altec Lansing Consumer Products, 717/296-2818, \$180. Lightweight powered speakers don't sound as good as they should. There's too much emphasis on the high end at the expense of the midrange, and they hiss noticeably. Dec 93

★★ **ACS150**, Altec Lansing Consumer Products, 717/296-2818, \$150. Subwoofer rounds out the sharp tones of the ACS100, but the bass response is neither punchy enough nor loud enough, and the unit is about the size and weight of a concrete block. Dec 93

★★ **Address Express**, CoStar Corp., 203/661-9700, \$795. Flaky performance and system crashes plagued this envelope-and-label printer in our tests, but the print quality was good. Oct 93

★★ **Apple Adjustable Keyboard**, Apple Computer, 408/996-1010, \$219. Keyboard is only a slight improvement on the flat slab keyboard. Theoretically, it corrects ulnar deviation, but many sufferers of repetitive stress injuries want a keyboard that adjusts vertically. Jul 93

★★★★ **AppleCD 300**, Apple Computer, 408/996-1010, \$599. Double-speed CD-ROM drive spins its discs at twice the speed of earlier drives, providing faster access to large files. Jun 93

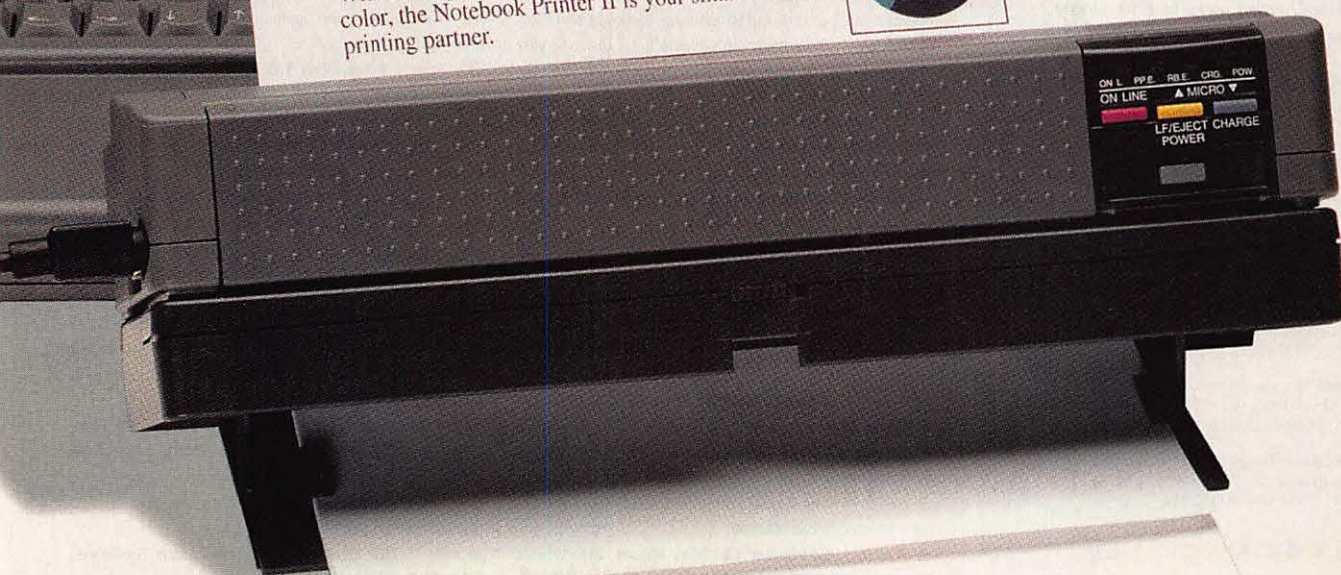
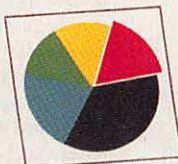
★★★★ **Apple Color OneScanner**, Apple Computer, 408/996-1010, \$1349. Tests of this color scanner demonstrate unpolluted colors and sharp image details, perhaps due to color filters and lenses that Apple claims were designed and tuned for the scanner. Jul 93

★★★ **AppleDesign Powered Speakers**, Apple Computer, 408/996-1010, \$179. Tall and curvy *continues*



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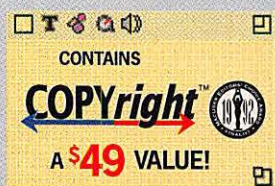
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 **Menus** configures the order of Apple menu items and adds hierarchical menus to folders to make file access easier than ever.



 **Notes** lets you create digital sticky notes that support text, graphics, sound, and QuickTime formats, and attach them to any folder.

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Star Ratings

powered speaker set looks and sounds good and can produce uncomfortably high volumes without noticeable distortion, but the bare-wire-and-terminal connections aren't user-friendly. Dec 93

★★★ **Apple Newton MessagePad, Apple Computer, 408/996-1010, \$699.** Although Apple released this personal digital assistant too early and marketing hype led to mistaken expectations, this is a very intelligent piece of work with an impressive variety of serious business uses. Dec 93

★★★ **Apple PowerCD, Apple Computer, 408/996-1010, \$400.** This extremely versatile and beautifully designed portable CD-ROM drive offers impressive audio and Photo CD features, but if you're a serious CD-ROM user, it's too slow to satisfy. Jan 94

★★★★ **ArtZ ADB Tablet, Wacom Technology Corp., 206/750-8882, \$449.** Combining pressure-sensitive operation, manageable size, and a new pencil-thin stylus, this affordable digitizing tablet is perfect for artists looking for traditional-style control of their graphics programs. Aug 93

★★★ **Computer Crayon, Appoint, 510/463-3003, \$49.** The kid contingent's verdict was a definite thumbs-up on this brightly colored input device that's shaped like a thick pencil. The buttons can be hard for smaller children to press, and serious computer artists should still opt for a drawing tablet. Oct 93

★★★★ **Coolscan LS-10e, Nikon Electronic Imaging, 516/547-4200, \$2600.** Compact desktop scanner for digitizing images from 35mm transparencies is slow, but delivers images good enough for newsprint publications and some catalogs. Dec 93

★★★ **EMBARC, Embarc Communications Services, 407/364-2000, \$395 plus fees.** If you're a PowerBook user who is frequently in places with no telephone and you need timely delivery of electronic news and E-mail, this portable wireless message service may prove useful, but the cost may be prohibitive to others. Sep 93

★★★★ **Epson ES-800C, Epson America, 310/782-0770, \$1499; Macintosh interface kit \$399.** Flexible 400-dpi scanner offers a range of options, including one- or three-pass scanning, plus a full-featured, easy-to-use software package. Aug 93

★★ **Gulliver, Appoint, 510/463-3003, \$119.** This diminutive mouse is hard to hold comfortably for an extended period, but it works well on almost any surface and is an acceptable option for PowerBook users. Oct 93

★★★ **Hello Music, Yamaha Corp. of America, 714/522-9240, \$449.95.** MIDI starter kit includes an impressive tone generator that's compatible with General MIDI Level 1 and Roland MT-32, but the included software is functional at best. Dec 93

★★★ **LightningScan Portable, Thunderware, 510/254-6581, \$459.** PowerBook owners will find this hand scanner's modem- or serial-port connection, lightweight interface, and total portability well worth the cost. The scanner is incompatible with some desktop Macs. Dec 93

★★★★ **Media Control Station 1.0 (1.01), JLCopier Electronics, 310/306-4131, \$269.95.** Versatile tool connects to the Mac through an ADB port and offers an easy and intuitive way to cue and edit QuickTime movies, MIDI files, and other dynamic data. Feb 93

★★★ **mira 35, Santos Technology, 310/320-8888, \$2695.** This 35mm slide scanner puts many sophisticated color-correction tools into a low-cost pack-

age. It does have trouble resolving extremely fine details, and its color correction is RGB only. Oct 93

★★★★ **Mirror 800 Plus Color Scanner, Mirror Technologies, 612/633-4450, \$1299.** Add the optional NuBus JPEG board (\$300) and the easy-to-use 35mm transparency scanning module (\$599), and this is a nifty—if slow—desktop scanning package for a reasonable price. Jan 94

★★★★ **PhonePro 1.0.3 (1.1.5), Cypress Research Corp., 408/752-2700, \$950.** Application makes it relatively easy to develop a multiple-choice voice-mail system using your Mac, especially for those with programming backgrounds. Feb 93

★★★ **PowerLink Presenter, E-Machines, 503/646-6699, \$499.** Simple, compact Duo dock wobbles a bit when plugged in but provides fine support for a variety of displays, plus ports for ADB, floppy drive, and sound output. Nov 93

★★★ **ScanMaker 35t, Microtek, 213/321-2121, \$1999.** Speedy 35mm film scanner accommodates loose film and delivers a good image, but the included software is weak. Dec 93

★★★ **ScanPlus Color 6000 for Mac, PlusTek USA, 408/980-1234, \$749 to \$899.** Small, inexpensive sheetfed color scanner is not appropriate if exact color matching is critical, but it is otherwise a good, economical option. Sep 93

★★★ **The UnMouse, MicroTouch Systems, 508/659-9000, \$199.** Input device is a cursor-control device, programmable keypad, and small graphics tablet in one, and can be programmed with 60 macros (although only 16 can be selected by sight). It's ergonomically better than a mouse, but not as good as a trackball. May 93

★★★ **Yamaha TG100, Yamaha Corp. of America, 714/522-9011, \$449.** Compact, keyboard-less, multitimbral MIDI synthesizer adheres to the General MIDI standard patch arrangement. Although it won't convince you that you're hearing a live orchestra, the sound is about as realistic as low-cost MIDI gets. Apr 93

MODEMS/NETWORK HARDWARE


★★★★ **AsantéHub 1012, Asanté Technologies, 408/435-8388, \$1299.** This 12-port, 10BaseT Ethernet hub works right out of the box and is a premium device at a bargain price. Dec 93

★★★ **DataLink PB; Axcell Cellular Interface, Applied Engineering, 214/241-6060, \$824.** If you need a full-blown office on the beach, this PowerBook cellular-modem package with automatic answering machine is a well-executed solution. Each recorded second requires 25K of disk space. Nov 93

★★★ **PerFit Port-A-Com, PerFit, 303/530-7333, \$349.** Compact, ADB-powered, high-speed fax/data modem is difficult to configure, due to its Spartan and poorly organized documentation, but is still a solid product at a reasonable price. Nov 93


★★★★ **Sportster 14,400 Fax/Data Modem, U.S. Robotics, 708/982-5001, \$329.** Several nice features, including an easily accessible power button and a front-mounted volume-control dial, make this 14,400-bps fax/data modem better than average. Feb 93

★★★ **SupraFaxModem 144PB, Supra Corp., 503/967-2400, \$349.95.** If you're looking for a high-



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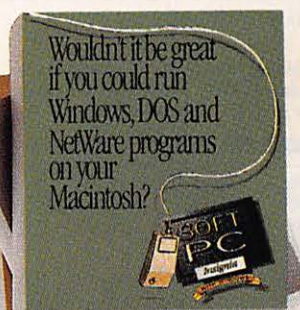
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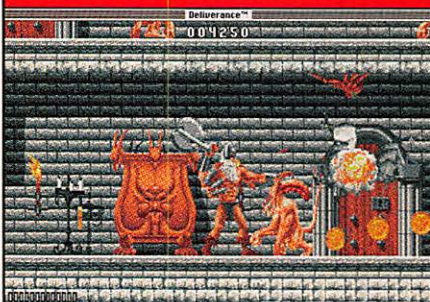
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PRINTERS

★★★ **Apple Color Printer, Apple Computer, 408/996-1010, \$2349.** If you need large-format color output, but not precision color-matching, this well-built printer is a reasonable choice, although it doesn't support PostScript. **Aug 93**

★★★★ **Apple Portable StyleWriter, Apple Computer, 408/996-1010, \$439.** Sleek, portable ink-jet printer weighs 4½ pounds and is a pleasure to use. It uses standard StyleWriter cartridges. **Jan 94**

★★★★ **DECtaser 1152, Digital Equipment Corp., 508/493-5111, \$999.** Four-pages-per-minute, 300-dpi, PostScript Level 2 printer offers simultaneous support for Macs and PCs, plus excellent image quality, for a ground-breaking price. **May 93**

★★★★ **HP LaserJet 4M, Hewlett-Packard, 800/752-0900, \$2399.** An Intel i8960 RISC processor makes printing complex images faster than ever with this 600-dpi printer. **Feb 93**

★★★★ **LaserWriter Pro 600 and 630, Apple Computer, 408/996-1010, \$2099 to \$2529.** From their paper handling to their print quality, these laser printers are Apple's best. Unfortunately, they don't support emulation-sensing, and thus may be less desirable for mixed-platform offices than other possibilities. **Jun 93**

★★★★ **LaserWriter Select 300, Apple Computer, 408/996-1010, \$839.** Inexpensive, low-capacity printer is networkable, and an excellent buy, despite a few weaknesses. Add a 4MB SIMM to take advantage of the amazing PhotoGrade capabilities, which allow the printer to generate 91 shades of gray. **Aug 93**

★★ **LaserWriter Select 310, Apple Computer, 408/996-1010, \$1099.** This big, slow printer is a true Adobe PostScript printer with both Mac and DOS ports, but it's not networkable or compatible with the Communications Toolbox, it can't automatically switch ports, and it doesn't have adjustable paper guides. **Aug 93**

★★★ **MobileWriterPS, Mannesmann Tally Corp., 206/251-5524, \$999.** Fast, portable printer is currently the only PostScript portable available. While the print quality is quite good on glossy laser paper, it's mediocre on inexpensive bond. **Dec 93**

★★★★ **Phaser 200i Color Printer, Tektronix, 503/682-7377, \$5995.** This thermal-wax color printer is fast and compact, with versatile paper-handling features. TekColor image-enhancement technologies provide excellent output quality that is, however, poor on letterhead and inexpensive photocopier bond. **Aug 93**

★★ **PrintPartner 10W, Fujitsu Computer Products, 408/432-6333, \$2450.** While this multiplatform printer is fast and prints clearly, many Mac users will find it frustrating as it can't print some TrueType fonts. **Jul 93**

★★★★ **StyleWriter II, Apple Computer, 408/996-1010, \$359.** Apple's ink-jet printer retains the best features of its predecessor, but costs less. New features, such as gray-scale printing and the ability to share the printer over a network, make it even more versatile. **Jun 93**

★★★★ **WideWriter, GCC Technologies, 617/275-5800, \$1699.** Large-format output is reasonably

priced with this ink-jet printer that can automatically feed sheets as large as 14 by 91 inches or manually feed sheets 17 inches wide with an unlimited length. **Feb 93**

★★★ **WriteMove II, GCC Technologies, 617/275-5800, \$599.** Portable printer for the PowerBook measures 11½ by 2 by 3½ inches and weighs 2½ pounds. It's no speed demon, but it's fine for short jobs. **May 93**

SYSTEMS/STORAGE

★★★★ **DataPak 105, Mass Microsystems, 408/522-1200, \$949 to \$1049.** Well-built 105MB SyQuest drive comes with a decent, no-frills cartridge-formatting package and a copy of 7th Heaven. The preformatted cartridges have a lifetime warranty. **Sep 93**

★★★★ **FastCache Quadra, Daystar Digital, 404/967-2077, \$299 to \$449.** PDS board provides 128K of secondary cache for a Quadra. The average real-world speed improvement is 15 percent, but some operations benefit more from the cache card than others. **May 93**

★★ **HP Optical Disk Library 10LC, Hewlett-Packard, 800/752-0900, \$9495.** Optical jukebox may fill the need for 10 gigabytes of online storage, but its performance is poor, and the software lacks the features needed for adequate management. **Jan 94**

★★★★ **Infinity 105 Turbo, Peripheral Land, 510/657-2211, \$795 to \$894.** Small, light, quiet, inexpensive 105MB SyQuest drive is ingeniously packaged and ideal for both desktop and PowerBook use. **Sep 93**

★★★★ **Infinity Optical 3.5, Peripheral Land, 510/657-2211, \$1999.** If you need the extra measure of permanence that magneto-optical storage provides—or a compact alternative to bulky cartridges—this drive, based on a Sony mechanism and using 3½-inch disks that store 120MB of data, deserves a look. **Jun 93**

★★★★ **Macintosh Centris 610, Apple Computer, 408/996-1010, 4/80 \$1859.** Slim-design Mac uses a 20MHz 68LC040 processor at a price-to-performance ratio that comes close to competing with Windows PCs; however, its expandability is severely limited. **Jun 93**

★★★★ **Macintosh Centris 650, Apple Computer, 408/996-1010, 4/80 68LC040 \$2699.** Moderately priced but fast 040 system offers three expansion slots and one drive bay, and (except for the base model) has built-in Ethernet, video circuitry, and a math coprocessor. **Jun 93**

★★★★ **Macintosh Duo Dock, Apple Computer, 408/996-1010, \$1079.** Clever housing for Duos provides back-panel connectors, a SuperDrive, support for external monitors, and two expansion slots. Some details, such as the difficulty of installing NuBus boards, belie Apple's usual attention to detail. **Mar 93**

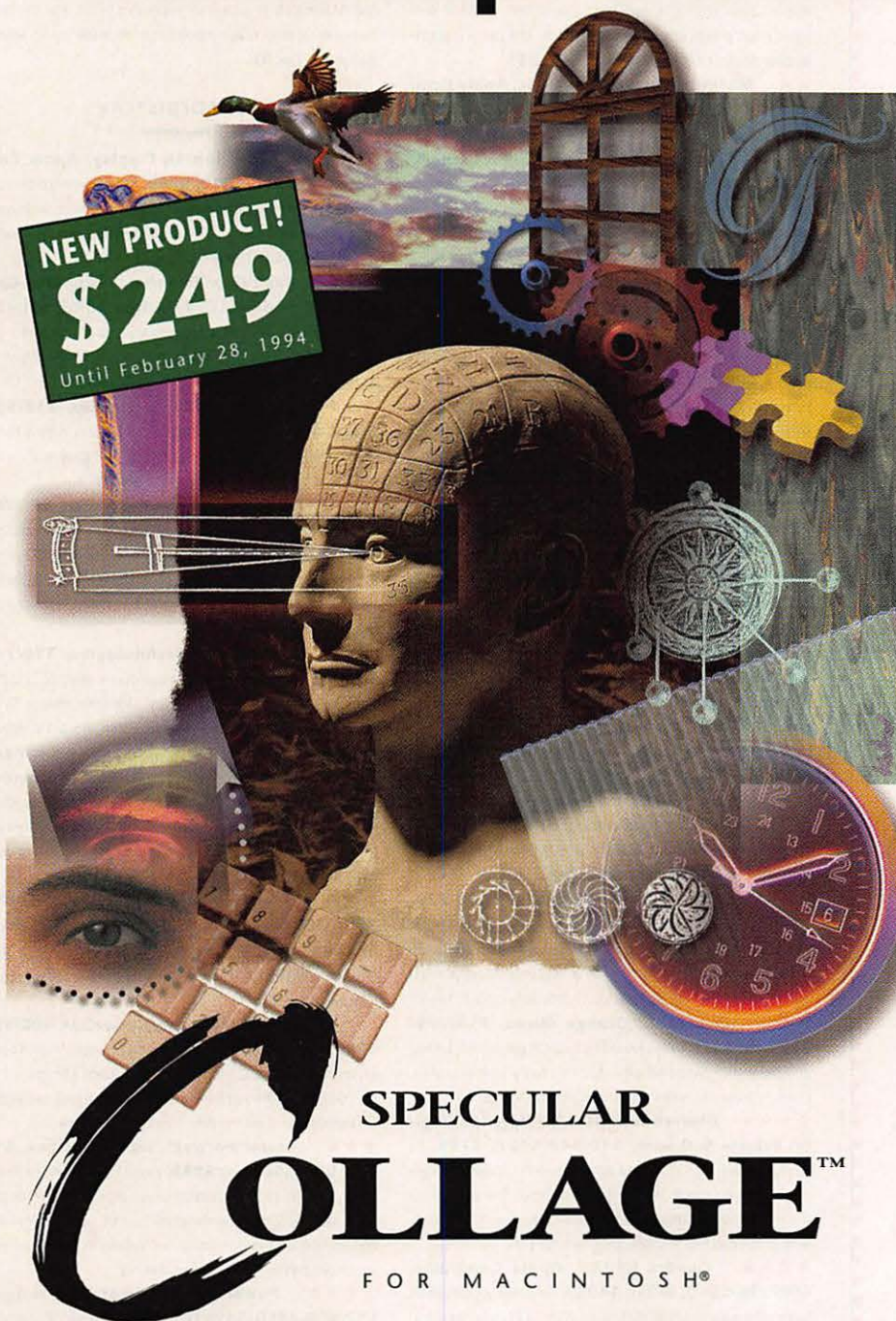
★★★★ **Macintosh LC III, Apple Computer, 408/996-1010, 4/80 \$1349.** Base system comes equipped with a 25MHz 68030 processor and 512K of VRAM. This is a machine that fits the bill and the pocketbook of most home or small-business owners. **Jul 93**

★★★★ **Macintosh PowerBook 145, Apple Computer, 408/996-1010, 4/40 \$2149.** Adequate but essentially outdated notebook computer is an upgraded PowerBook 140 with a faster 25MHz 68030 CPU. **Feb 93**

★★★★ **Macintosh PowerBook 160, Apple Computer, 408/996-1010, 4/40 \$2429.** A built-in video port and gray-scale capability are the new features *continues*

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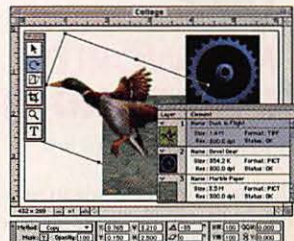
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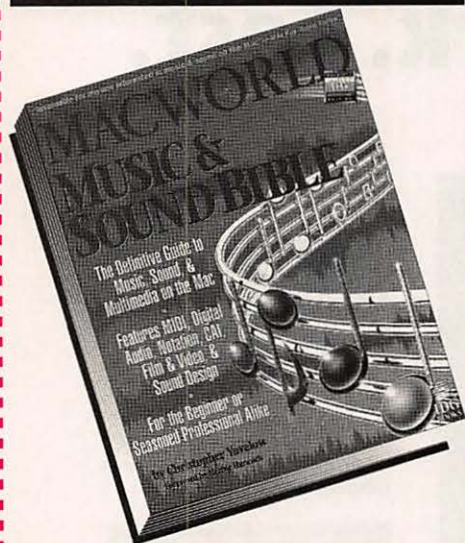
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Apple offers with this notebook computer. While it provides good processing speed and power, the passive matrix display doesn't cut it for all-day use. Feb 93

★★ **Macintosh PowerBook 165c, Apple Computer, 408/996-1010, 4/80 \$3399.** The passive matrix screen of this color notebook computer is dull and has noticeable afterimages, but if your expectations are reasonable, the speedy processor provides a pleasant environment in which to work. Jul 93

★★★★ **Macintosh PowerBook 180, Apple Computer, 408/996-1010, 4/80 \$4109.** An active matrix screen and math coprocessor are the only differences between this computer and the PowerBook 160, but the beautiful display is worth the extra \$1000. Feb 93

★★ **Macintosh PowerBook 180c, Apple Computer, 408/996-1010, 4/80 \$4169.** The active matrix screen of this color notebook computer is beautiful but so small that its usefulness is very limited. Sep 93

★★★★ **Macintosh PowerBook Duo 210 and 230, Apple Computer, 408/996-1010, 210 (4/80) \$1839, 230 (4/80) \$2299.** Apple's smallest computers have the pleasing heft of hardbound books but pack the horsepower of 030 chips. Although the screen, keyboard, and trackball feel small, these computers virtually cry out to be picked up and used. Mar 93

★★★★ **Macintosh Quadra 800, Apple Computer, 408/996-1010, 8/230 \$4679.** Squat, yet curvy and attractive, this minitower system has fewer expansion opportunities than the Quadra 950, but just as much power. It's fast, slick, and moderately priced. Aug 93

★★★★ **MicroMac Plus Upgrade System, MicroMac, 714/362-1000, \$998.** This 68030 accelerator for the Mac Plus requires disassembling a Plus and using the Plus system board to assemble the MicroMac system. It speeds up the Plus dramatically, and supports an included external full-page monochrome monitor. Jun 93

★★★★ **MultiDisk 150, Iomega, 801/778-1000, \$1225.** Durable cartridges are one of the strongest reasons to choose this Bernoulli removable drive. Although it's slightly more expensive than a SyQuest drive, it's fast and reliable, and the disks are competitively priced. Jun 93

★★★★ **OrangePC, Orange Micro, 714/779-2772, \$1799.** NuBus board has a DOS processor, letting you have your Mac and a PC, too. It's fairly well executed, though there are some minor problems. Oct 93

★★★★ **PowerBook 140 F/25 Upgrade, Digital Eclipse Software, 510/547-6101, \$399.** By changing the oscillators and adding an FPU, Digital Eclipse changes PowerBook 140s into 170s, minus the active matrix screen. While the upgrade seems expensive, it's the only way to extend the viability of a 140. Dec 93

★★★★ **Quadra 840AV, Apple Computer, 408/996-1010, 8/230 \$4069.** Technological tour de force uses a 40MHz 68040 and an AT&T 3210 digital signal processor, and is brimming with sophisticated speech-recognition and audiovisual technology. Beware of some hardware and software incompatibilities. Dec 93

★★★ **SmartStack, Envisio, 612/628-6288, SmartSource \$119; SmartModules \$289 to \$1379.** The SmartStack line of modular storage peripherals may be neatly stacked on top of a common power supply to reduce desktop clutter and cabling problems. Sep 93

★★★ **Turbo 040, DayStar Digital, 404/967-2077, \$1899.** This accelerator card is equipped with the fastest 68040 chip available, and is as fast as or faster than

any Macintosh in processor-intensive tasks. For the price, however, it may make more sense to trade up to a faster computer. Dec 93

VIDEO/DISPLAY

★★★★ **AudioVision 14 Display, Apple Computer, 408/996-1010, \$769.** Monitor integrates audio and video with built-in speakers that produce surprisingly rich, full-bodied sound. The display, while nice, is small for multimedia work. Dec 93

★★★★ **BookView Imperial, Computer Care, 612/371-0061, \$1399 (includes 6MB of RAM).** This notebook-display adapter supports all common sizes of monitors. It is expensive, however, and uses 2MB of system memory for video processing. Feb 93

★★★★ **Dycam Model 3, Dycam, 818/998-8008, \$895.** Low-end, digital still camera is easy to use, and is a solid product if Instamatic grade gray-scale meets your image-quality requirements. Sep 93

★★★★ **Editing Aces Suite, RasterOps, 801/785-5750, \$3899.** Video professionals can record and play back full-screen movies in 24-bit color with 16-bit CD-quality sound with this collection of products. Despite flaws, this package represents a step forward in QuickTime technology. Nov 93

★★★★ **L-TV, Lapis Technologies, 510/748-1600, \$349.** Interface board allows a Mac LC, LC II, or Performa to use a TV as a display. Unfortunately, a TV is a poor substitute for a monitor, so while the L-TV does its job, the setup is unsuitable for many applications. May 93

★★★★ **Lightning Effects II, Spectral Innovations, 408/955-0366, \$1295.** Digital-signal-processor chips dramatically speed up some Photoshop operations with this expensive Photoshop-acceleration board. It had problems acquiring some JPEG files. May 93

★★★★ **MovieMovie, Sigma Designs, 510/770-0100, \$349.** This 7-inch NuBus video-capture board may be what you've been waiting for. The price is right, and the addition of on-board audio input is a plus, even if it is only mono. Dec 93

★★★★ **PaintBoard Turbo, RasterOps, 408/562-4200, \$1499.** Midrange video board supports 24-bit color on monitors up to 17 inches and resolutions as high as 1024 by 768 pixels. If you can live without changing resolutions on the fly, it's a reasonably good deal. Oct 93

★★★★ **Power Portrait, Sigma Designs, 510/770-0100, \$899 or \$949.** Hook your Classic or PowerBook to this 15-inch portrait-style monochrome display. Built-in QuickDraw acceleration speeds up the slow SCSI connection on the one hand and results in a few software incompatibilities on the other. Feb 93

★★★★ **PowerVision, Mirror Technologies, 612/633-4450, \$499 to \$999.** Separate VRAM means you don't lose system memory with this nicely priced notebook display adapter. Feb 93

★★★★ **ThunderStorm, SuperMac Technology, 408/245-2202, \$699.** Photoshop-acceleration board uses digital-signal-processor chips to speed up some Photoshop operations. It's fast, with good JPEG compatibility and a great manual. May 93

★★★★ **VideoToolkit 2.0.1, Abbate Video, 508/376-3712, \$279.** Despite a few rough edges, this is an attractive, inexpensive solution for those who need to catalog and edit videotapes on a budget. Sep 93 **III**



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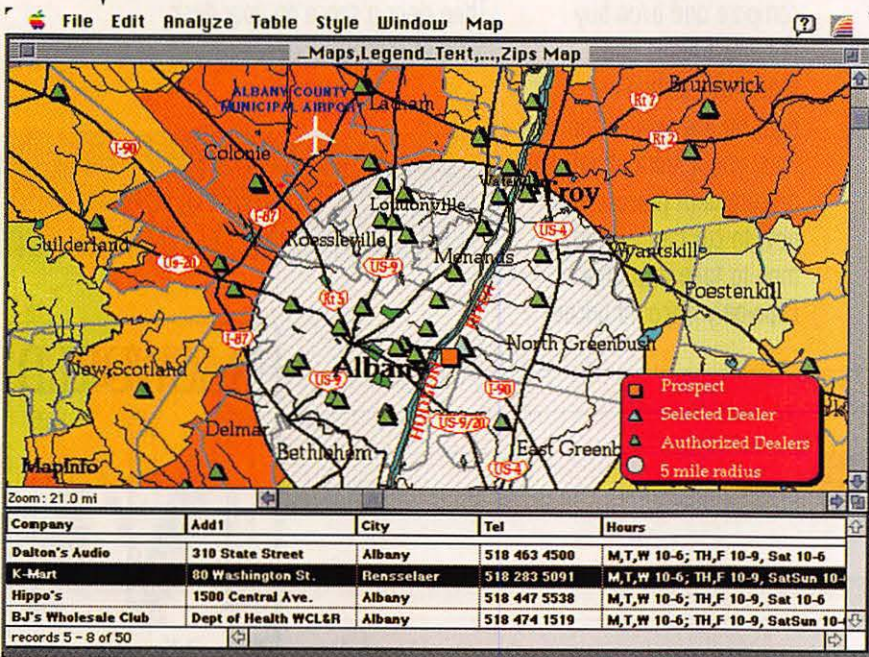
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19 Audio Lab II	1145 Lawler Ave.	Albany	555-8049	M,T,W 10-6; Th-Fr 10-9
20 Milton Stereo	189 Central Ave.	Albany	555-4395	M,T,W 10-6; Th-Fr 10-9
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22 Pettig's Stereo	2764 Consort Rd.	Schenectady	555-8424	M,T,W 10-6; Th-Fr 10-9
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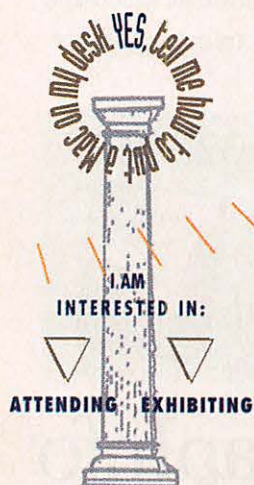
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Selected and edited by Charles Barrett

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Listings indicate the star rating awarded in *Macworld's* Reviews (products rated ★★ or lower are not eligible to be listed), if the product has been chosen as an **Editors' Choice**, and if it has won a **World-Class** award. In some cases, the editorial evaluation quoted is for an earlier product version.

Vendors and resellers desiring to have products and services considered for inclusion in this section are encouraged to mail or fax press releases, or to call the *Streetwise Shopper* editor with particulars (contact information shown above).

BUNDLES

DateBook Pro 2.0 and TouchBase Pro 3.0 Bundle + Quicken 4 Aldus has added Intuit's \$69.95 Quicken personal-finance package (Nov 93 ★★★★★—"easy to learn and powerful to use") to its \$89.95 personal time manager and personal contacts manager bundle (Feb 94 ★★★★★—"superior combination of integration, usefulness, and features," "bundled for a street price under \$100, they're a steal"). Available through The Mac Zone (800/248-0800), Mac's Place (800/367-4222), MacConnection (800/800-2222), and MacWarehouse (800/255-6227) for between \$89 and \$99. Offer expires 1/31/94.

EtherPeek 2.0.3; LocalPeek 2.0.3; or TokenPeek 2.0.3 + Silver Cloud 1.2 The AG Group is including a \$495 25-user pack of its Silver Cloud network-management software (Feb 94 ★★★★★—"major improvement over Apple's Chooser and a powerful productivity tool") free with any of its trio of Ethernet, LocalTalk, and Token Ring network analyzers (Jan 94 ★★★★★—"priced at a small fraction of the cost of dedicated hardware analyzers, these tools give you better analysis and a friendlier interface" for version 1.0) when purchased direct (800/466-2447) with a 12- or 24-month service contract. For example, the EtherPeek product/service bundle is \$950 (regularly \$1445) and \$1100 (regularly \$1595), respectively. Offer expires 3/31/94.

PowerPrint + MacLinkPlus Translators Pro 7.5 GDT Softworks is bundling its \$149 PowerPrint utility (includes spooler and cable) for connecting to over 1000 PC-compatible printers (Sep 93 "Maximize Your Printer" **Editors' Choice**—"fewest problems handling graphics files," "top in most speed tests") with DataViz's \$149 MacLinkPlus translation library and Apple's Macintosh PC Exchange, which permit files to be translated between Macs and PCs without loss of formatting. John Rizzo's book, *Guide to Connectivity* (Ziff-

Davis, 1993), is also included. Available through retail and mail order for \$139 to \$199 (regularly \$198 to \$298). Offer expires 2/28/94.

COMPETITIVE UPGRADES

DriveCD 1.0 Casa Blanca Works is offering this new \$59.95 product for improving CD-ROM disc access speeds (complete with an AudioCD cdev, multisession Photo CD compatibility, and full support for Apple SCSI Manager 4.3 and SCSI 2) for \$29.95 to users of any third-party CD-ROM driver package. To qualify, fax manual cover (415/461-2249) or send in master floppies (148 Bon Air Center, Greenbrae, CA 94904). Offer expires 2/28/94.

Hard Disk ToolKit 1.5; SCSI JackHammer FWB is offering its \$199 SCSI utility Hard Disk ToolKit software to owners of any non-Apple formatting utility for \$99. Its \$799 Fast & Wide SCSI JackHammer accelerator NuBus card (including special version of Hard Disk ToolKit) is being offered for \$499 to owners who turn in their PLI QuickSCSI or MicroNet NuPort cards. Available direct (415/474-8055) or through MacConnection (800/800-2222). Offers not to expire before 2/28/94.

MasterFinder 1.2.1 Olduvai Corp. is offering this \$149 Finder utility (Nov 92 ★★★★★—"most potent feature is its ability to manipulate multiple files and folders at the same time") direct (305/670-1112, 800/548-5151) to users of any file-management utility for \$39. Offer expires 3/31/94.

DISCOUNTS/REBATES/FREE OFFERS

addDepth 1.0.2 Ray Dream is offering this \$179 graphics utility for enhancing 2-D images with 3-D effects (Aug 93 ★★★★★—"versatile, accommodating, and affordable") direct (800/846-0111) for \$99 (includes 30-day money-back guarantee). Offer not to expire before 1/31/94.

ArchiCAD 4.02 Graphisoft's PowerPC Upgrade Plan reimburses new buyers of this \$4450 architectural CAD software (Jun 92 ★★★★★—"powerful, full-featured, integrated") \$500 with the PowerPC logic board or accelerator upgrade of their choice, provided purchase of the upgrade is made within three months of introduction. The cost of this upgrade plan is \$95. ArchiCAD 4.5 for PowerPC and 680X0 Macs is due for release next spring. For further information, call Graphisoft at 800/344-3468. Offer expires 1/31/94.

Avid VideoShop 2.0 Avid Technology's Desktop Video Group is offering this \$499 QuickTime video-editing program (Feb 94 ★★★★★—"shines in its intuitive, easy-to-use interface") direct (800/394-3482) for \$88 as an extension of its San Francisco Macworld Expo special. Offer expires 1/31/94.

BigFont Collection TigerSoftware is offering this collection of 2000 professional, scalable typefaces that have been digitally transferred by a prestigious type foundry for

razor-sharp output. Rivaling Adobe, Agfa, Bitstream, Image Club, Monotype, and Microsoft in both quality and diversity, each face includes a complete lexicon. There are 10 TrueType or PostScript font libraries to choose from, with individual library volumes of 200 fonts each, available on disk. One 200-font volume sells for \$59, two volumes for \$79, and additional volumes are \$39 each. The entire 10-volume collection is \$379 on CD-ROM, and \$399 on disk. Call TigerSoftware (800/230-6299) to order and to obtain the complete BigFont catalog. Offer not to expire before 2/28/94.

MultiClip 2.1.7 Olduvai Corp. is offering this next-to-most-recent version of its \$149 Clipboard/Scrapbook-replacement utility (see Aug 90 review for version 2.0) direct (305/670-1112, 800/548-5151) for \$9.95 (plus S&H). Purchase includes free MultiArt collection of clip art and sounds, plus special price of \$39.95 for MultiClip 3.0 upgrade. Offer expires 3/31/94, or until supplies are depleted.

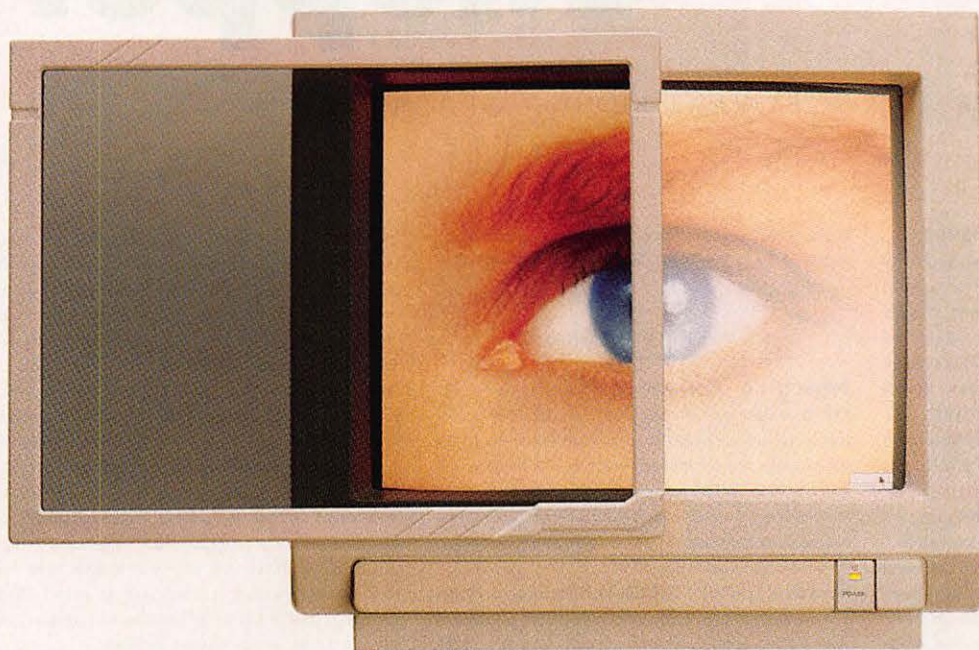
PowerBooks and Apple Peripherals Apple Computer is offering "instant" rebates at the point of sale (after signing a rebate verification form) to customers who purchase a qualifying product (\$100 for a PowerBook 165, 165c, or PowerBook Mini Dock; \$150 for a PowerBook 145B or Duo Dock; \$200 for a PowerBook 180 or Apple 16" Color Display; \$300 for a Duo Dock with 230MB HD or Apple Color Printer; \$350 for Duo 230 4/120 or Duo 230 4/80 with floppy adapter and external drive; \$450 for a PowerBook 180c; \$500 for Duo 230 4/160 with Duo Dock and Express Modem). To locate a participating reseller, call 800/538-9696. Offer expires 1/31/94.

Software Dispatch for Macintosh Apple Computer's Software Dispatch business unit is offering this CD-ROM software-delivery system that permits customers to try, compare, and buy more than 80 third-party software applications via guided tours and limited trial versions. A QuickTime tutorial explains the trial and purchase process. These CDs are to be updated quarterly with new versions and applications. Customers can call an 800 number at any time to purchase keys that unlock software and manuals for immediate installation. Call 800/937-2828, ext. 600, to obtain free discs.

Tableworks Plus 1.06 Npith is offering this publishing utility XTension for adding table-creation and -editing facilities to QuarkXPress (Jan 94 ★★★★★—"a must-have for anyone doing even mildly complex tables" for version 1.05) direct (206/392-7745) or through XChange (800/788-7557, ext. 1010) for \$249 (regularly \$299). Offer expires 1/31/94.

TransWarp 6400 Series Accelerators Applied Engineering is offering a \$50 rebate on the selling price of its line of 25MHz, 33MHz, and 40MHz 68040 accelerators for the Mac IIci, IIsi, IIfx, and Performa 600—the \$849 6425f, \$999 6433f, and \$1249 6440f. To qualify, customers must turn in their old cache or expansion card to Applied Engineering or any authorized dealer. For further details about the \$50 Cache-Back program, call 800/554-6227. Offer not to expire before 3/31/94. ■

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Page No.	Advertiser	Reader Svc. No.	Phone	Page No.	Advertiser	Reader Svc. No.	Phone	Page No.	Advertiser	Reader Svc. No.	Phone
26	Aatrix Software	159	800/426-0854	12	GDT Softworks	42	800/663-6222	188-189	RasterOps	90	800/SAYCOLOR
155D	Agfa/Scanner	158	800/685-4271	175,177-179	GE Information	97	800/638-9636				
176	Agio Designs	—	800/688-2446	212	Global Village	156	800/736-4821	136-137	Seiko Inst. USA	149	—
48	Aladdin Systems	195	408/761-6200	157	Graphsoft	46	410/290-5114	78	Sharp		
140-141	Aldus	—	800/685-3517						Electronics Corp.	13	800/BE-SHARP
20	Aldus Consumer Division	145	800/888-6293	166-167	Hewlett Packard	—	—	202	Sophisticated Circuits	118	800/827-4669
203-204	America Online	—	—	100-101	Hewlett Packard	—	800/SCANJET	241H	Statsoft International	41	800/433-7732
46	American Power Conversion	72	800/788-2208	121	Hewlett Packard	—	800/LASERJET	80	Statsoft	99	918/583-4149
8	Anthro	—	800/325-3841	74	HSC Software	5	310/392-8441	170	Steck-Vaughn Publishing Company	19	800/531-5015
198	Apple	—	—					13	Supernac	88	800/334-3005
158-159	Applied Engineering	168	800/554-MACS	10	Image Club Graphics	50	800/661-9410	225	Supra	132	800/967-8772
195	Applied Engineering	167	800/554-MACS	240	Inline Software	61	800/453-7671	40	Symantec-SAM	180	—
	APS Technologies	—	—	239	Insignia Solutions	68	800/848-7677	168	Symantec-NUM	85	—
172	ASD Software	170	800/255-6227	65	Inspiration Software	104	800/877-4292				
28	Attain Corporation	6	617/776-1110	155C	Iomega	111	800/967-0326				
201	Axon	56	800/8AXION1					190	Technöggin, Inc.	94	800/305-7936
				BC	Kensington	—	—	62	Tektronix	143	800/835-6100
174	Berkeley Systems	—	800/248-0800		Microware Ltd.	—	800/535-4242	39	Teleware, Inc.	194	800/851-1315
220	Brookstone	—	800/225-3326								
60	Caere Corp.	69	800/535-SCAN	15-19	La Cie	52	800/999-1182	44	UsrEz Software	36	714/756-5140
287	CD ROM	—	800/225-3326	227	Lapis Technologies	107	800/43LAPIS				
215	Central Point Software	93	800/277-3873	155B	LaserMaster	43	800/950-6868	214	VST Power Systems	73	508/287-4600
66	Charles River Analytics Inc.	18	800/913-3535	14	Lind Electronic Design	82	800/659-5956				
67	Checkmark Software	34	800/444-9922					6-7	Wordperfect	—	800/526-7820
9	Chinon America, Inc.	64	800/441-0222	152-154	Mac Zone, The	70	—	209	Xante Corporation	1	800/926-8839
171	Chipsoft	—	800/964-1040	58	MacAcademy	106	800/257-1914				
237	Citizen America Corporation	83	800/4-PRINTERS	68-73	MacConnection	—	800/800-3333				
76	Clarix	—	800/544-8554	10	MacTable/Scanco	—	800/722-6263				
84-85	Clarix	—	800/544-8554	244	Macworld Expo	—	—				
229	Coactive Computing Corp.	142	800/825-2NET	208	Macworld Expo	—	—				
131-133	Communication Intelligence Corp.	—	800/888-9242	243	MapInfo Corporation	11	800/327-8627				
109	Compuserve	66	800/848-8199	216	Maxis	40	510/254-9700				
110-111	Computer Associates	10	800/225-5224	24	MicroNet Technology	113	714/463-6100				
200	Connectix	189	800/950-5880	173	MicroNet Technology	139	714/453-6100				
23	Contemporary Cybernetics Group	188	804/873-9000	IFC-1	Microsoft	—	—				
233	Corel Corporation	78	800/836-3729	193	Microtek Lab, Inc.	169	800/654-4160				
30-31	Creative Labs	51	800/998-LABS	148	Mirror Technologies	125	800/643-0624				
222	CTX International	38, 39	909/595-6146	149	Mirror Technologies	122	800/643-0624				
				147	Mirror Technologies	124	800/643-3384				
176	Dantz Development	26	510/253-3000	238	MSA Inc.	130	800/366-4622				
82	DataViz	79	800/733-0030	194	Multi-Ad Services	187	800/447-1950				
231	DataWatch	37	919/549-0711	208	MWCDV	—	—				
187	Dayna Communications	161	801/269-7200	156	National Instruments	71	800/433-3488				
32	Daystar Digital	7	800/DIGITAL	IBC	NEC Technologies	16	800/NEC-INFO				
49	Delrina Technology	23	800/268-6082	2-3	NEC Technologies	17	800/NEC-INFO				
99	Delrina Technology	137	800/268-6082	56	No Hands Software	27	800/598-3821				
29	Deneba Software	57	800/6CANVAS	210	Now Software	133	800/275-5669				
196-197	Digital Equipment Corporation	120	800/DEC-INFO	22	nView Corporation	117	800/736-8439				
				246	OCLI	129	800/949-5053				
27	E-Machines	136	800/344-7274	155A	Personal Training Systems	44	800/832-2499				
122-123	Eastman Kodak	45	800/CD-KODAK	43	Pinnacle Micro	55	800/553-7070				
310-311	Educorp	157	800/843-9497	45	Pinnacle Micro	115	800/553-7070				
207W	Engineered Software	12	919/299-4843	47	PLI	108	800/288-8754				
50-51	Epson	—	800/BUY-EPSON								
				235	QMS	—	800/392-7559				
11	Focus Enhancements	163	800/538-4888	170	Quantum Leap Technologies	101	305/446-4141				
42	Fractal Design	190	800/647-7443								
				219	Radius	14	800/227-2795				

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Page No.	Advertiser	Reader Svc. No.	Page No.	Advertiser	Reader Svc. No.	Page No.	Advertiser	Reader Svc. No.	Page No.	Advertiser	Reader Svc. No.
SOFTWARE			NETWORKING			EXPANSIONS/UPGRADES			SECURITY		
BUSINESS			56	No Hands Software	27	147	Mirror Technologies	124	209	Xante Corporation	1
26	Aatrix Software	159	OCR	Caere Corp.	69	IBC	NEC Technologies	16	46	American Power Conversion	72
20	Aldus Consumer Division	145				22	nView Corporation	117	VIDEO		
28	Attain Corporation	6	PERSONAL			HARD DISKS/STORAGE			147	Mirror Technologies	124
67	Checkmark Software	34	171	Chipsoft	—	195	Applied Engineering	167	219	Radius	14
76	Clarix	—	POWERBOOK			158-159	Applied Engineering	168	188-189	RasterOps	90
84-85	Clarix	—	40	Symantec-SAM	180	32	Daystar Digital	7	13	Supermac	88
110-111	Computer Associates	10	168	Symantec-NUM	85	ON LINE			203-204	America Online	—
30-31	Creative Labs	51	SECURITY			279	Direct Connections	121	109	Compuserve	66
231	DataWatch	37	44	UsrEz Software	36	273	International Mac Specialists	103	175,177-179	GE Information	97
49	Delrina Technology	23	STATISTICAL			155C	lomega	111	TRADESHOWS/CONFERENCES		
65	Inspiration Software	104	156	National Instruments	71	15-19	La Cie	52	287	CD ROM	—
IFC-1	Microsoft	—	80	Statsoft	99	257	MacDirect	58	244	Macworld Expo	—
56	No Hands Software	27	UTILITIES			276	MacProducts USA	175	208	Macworld Expo	—
210	Now Software	133	48	Aladdin Systems	195	24	MicroNet Technology	113	TRAINING		
155A	Personal Training Systems	44	172	ASD Software	170	173	MicroNet Technology	139	58	MacAcademy	106
80	Statsoft	99	174	Berkeley Systems	—	43	Pinnacle Micro	55	ACCESSORIES		
39	Teleware, Inc.	194	215	Central Point Software	93	45	Pinnacle Micro	115	FURNITURE		
6-7	Wordperfect	—	200	Connectix	189	47	PLI	108	176	Agio Designs	—
CAD/CAM			176	Dantz Development	26	267	SuperMicro	126	8	Anthro	—
207W	Engineered Software	12	231	DataWatch	37	277	Third Wave	186	10	MacTable/Scanco	—
157	Graphsoft	46	12	GDT Softworks	42	INPUT DEVICES			MISCELLANEOUS		
CD ROM			238	MSA Inc.	130	131-133	Communication Intelligence Corp.	—	10	MacTable/Scanco	—
233	Corel Corporation	78	210	Now Software	133	BC	Kensington	—	246	OCLI	129
122-123	Eastman Kodak	45	40	Symantec-SAM	180	202	Sophisticated Circuits	118	MAIL ORDER		
310-311	Educorp	157	168	Symantec-NUM	85	MISCELLANEOUS			274-275	Alliance Peripheral Systems	62
170	Quantum Leap Technologies	101	VERTICAL			60	Caere Corp.	69	282-283	Club Mac	96
170	Steck-Vaughn Publishing Company	19	26	Aatrix Software	159	131-133	Communication Intelligence Corp.	—	279	Direct Connections	121
COMMUNICATION			156	National Instruments	71	BC	Kensington	—	279	Educational Resources	28
30-31	Creative Labs	51	WORD PROCESSING			201	Microware Ltd.	—	252-253	Express Direct	81
82	DataViz	79	76	Clarix	—	212	Global Village	156	273	International Mac Specialists	103
49	Delrina Technology	23	6-7	Wordperfect	—	225	Supra	132	152-154	Mac Zone, The	70
239	Insignia Solutions	68	HARDWARE			MODEMS			269-272	Mac's Place	250
EDUCATIONAL			BOARDS			229	Coactive Computing Corp.	142	256	MacCenter	105
279	Educational Resources	28	195	Applied Engineering	167	187	Dayna Communications	161	68-73	MacConnection	—
155A	Personal Training Systems	44	158-159	Applied Engineering	168	11	Focus Enhancements	163	257	MacDirect	58
170	Steck-Vaughn Publishing Company	19	219	Radius	14	POWERBOOKS			258-266	MacMail	131
ENTERTAINMENT			188-189	RasterOps	90	27	E-Machines	136	284-285	MacNews	172
174	Berkeley Systems	—	13	Supermac	88	227	Lapis Technologies	107	276	MacProducts USA	175
99	Delrina Technology	137	CD ROM			14	Lind Electronic Design	82	254-255	MacWarehouse	150
240	Inline Software	61	9	Chinon America, Inc.	64	190	Technoggin, Inc.	94	278	Microtech Int'l	116
216	Maxis	40	310-311	Educorp	157	214	VST Power Systems	73	148	Mirror Technologies	125
GRAPHICS/PTP			267	SuperMicro	126	PRINTERS			149	Mirror Technologies	122
140-141	Aldus	—	COMPUTER SYSTEMS			237	Citizen America Corporation	83	268	Printer Connection	91
84-85	Clarix	—	198	Apple	—	196-197	Digital Equipment Corporation	120	277	Third Wave	186
110-111	Computer Associates	10	280-281	BottomLine Distribution	63	166-167	Hewlett Packard	—	MISCELLANEOUS		
233	Corel Corporation	78	268	Printer Connection	91	121	Hewlett Packard	—	12	GDT Softworks	42
29	Deneba Software	57	DIGITIZERS/SCANNERS			155B	LaserMaster	43	65	Inspiration Software	104
122-123	Eastman Kodak	45	155D	Agfa/Scanner	158	2-3	NEC Technologies	17	243	MapInfo Corporation	11
42	Fractal Design	190	50-51	Epson	—	235	QMS	—	MULTIMEDIA		
74	HSC Software	5	100-101	Hewlett Packard	—	136-137	Seiko Inst. USA	149	42	Fractal Design	190
10	Image Club Graphics	50	193	Microtek Lab, Inc.	169	78	Sharp Electronics Corp.	13			
194	Multi-Ad Services	187	149	Mirror Technologies	122	62	Tektronix	143			
241H	Specular International	41	DISPLAY								
			222	CTX International	38 & 39						
			252-253	Express Direct	81						
			227	Lapis Technologies	107						
			284-285	MacNews	172						
			148	Mirror Technologies	125						

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A. Including yourself, approximately how many people are employed at your entire work-site (i.e., employees in your office, building, or cluster of buildings)? (Check one.)

- 01 ☐ 1000+
02 ☐ 999 - 100
03 ☐ 99 - 25
04 ☐ Under 25

B. Which of the following computers are installed at this entire work-site? (Check all that apply.)

- 05 ☐ Apple Workgroup Servers/
Mac Quadra-series
06 ☐ Mac Centris-series/II-series/LC III/
Performa 600/450/SE 30
07 ☐ Mac LC/LC II/Performa 430/405/
400/200/Classic-series/SE/Plus/
512K/128K/Portable
08 ☐ Mac PowerBook-series/Duo-series

C. What is the total number of Macs installed at this entire work-site? (Check one.)

D. For how many Macintosh computers within this entire work-site do you have purchase involvement for products and/or services? (Check one.)

- | | | |
|-----------|-----------------------------|-----------------------------|
| | C | D |
| 500+ | <input type="checkbox"/> 09 | <input type="checkbox"/> 15 |
| 499 - 100 | <input type="checkbox"/> 10 | <input type="checkbox"/> 16 |
| 99 - 50 | <input type="checkbox"/> 11 | <input type="checkbox"/> 17 |
| 49 - 10 | <input type="checkbox"/> 12 | <input type="checkbox"/> 18 |
| 9 - 1 | <input type="checkbox"/> 13 | <input type="checkbox"/> 19 |
| None | <input type="checkbox"/> 14 | <input type="checkbox"/> 20 |

E. In which ways are you ever involved in purchase decisions for Macintosh products at this entire work-site? (Check all that apply.)

- 21 ☐ Initiate/Determine need for product/capabilities/features
22 ☐ Evaluate, recommend, or approve brands/models
23 ☐ Evaluate, recommend, or approve purchase source
24 ☐ Authorize purchases

F. Over the next 12 months, how much will this entire work-site spend on Macintosh products and/or services? (Check one.)

- 25 ☐ \$1 million or more
26 ☐ \$999,999 - \$500,000
27 ☐ \$499,999 - \$100,000
28 ☐ \$99,999 - \$50,000
29 ☐ \$49,999 - \$10,000
30 ☐ Under \$10,000

G. Considering the entire work-site, which of the following Macintosh hardware and software products are currently installed? (Check all that apply.)

- 31 ☐ Business software (Word processing, spreadsheet, database, etc.)
32 ☐ Graphics/publishing software
33 ☐ Monitors/displays
34 ☐ Printers/scanners
35 ☐ Networking/communications hardware and/or software
36 ☐ Multimedia/AV hardware and/or software
37 ☐ Mobile computing products (PowerBooks, peripherals, software, etc.)

H. What is your primary job function? (Check one.)

- 38 ☐ Computer Reseller/VAR/VAD
39 ☐ MIS/DP/IS/Network Management
40 ☐ Engineering
41 ☐ R&D/Scientific
42 ☐ Corporate/General Management
43 ☐ Accounting/Finance
44 ☐ Marketing/Sales/PR/Communications
45 ☐ Art/Design/Creative Services

Thank You!

Please print or type all information.

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				Serial Switches	302
				Track Balls	301
				PowerBook	301
274-275	Bottomline Distribution	63	512/472-4956	BUSINESS TOOLS	
				Bar Code	288, 289
				Credit Authorization	288
				Point of Sale	288
				Property Management	288
				Translation	288
282, 283	Club Mac	96	800/CLUB-MAC	EDUCATIONAL & RECREATIONAL	
				Astrology	303
				Astronomy	302
				Discount Software	302
				Flashcards	303
				Games	303
				Genealogy	302, 303
				Grading	302, 303
				Lottery	302
				Music	303
				Religion	302
279	Direct Connections	121	800/572-4305	GRAPHICS	
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				On-Line Services	303
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				Slides	308
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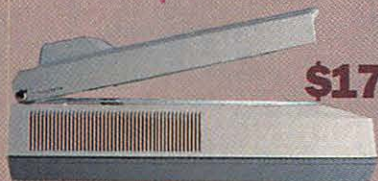
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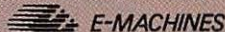


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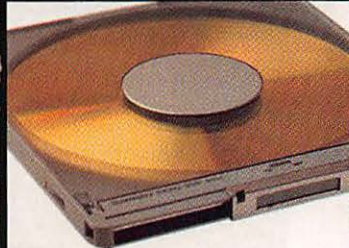
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WISE GUY

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1984 Redux

How Macintosh could have taken over the world

BACK IN 1984 WHEN WE launched the Macintosh, one of the slides we used in presentations was a drawing of a man in a blue suit with a "No" symbol around him. It stood for no blue suits, or no IBM. We used this slide because one of our main goals for Macintosh was to send IBM back to the typewriter business with its (Selectric) balls in hand. Another major goal was to dominate the personal computer business—out-IBMing IBM, if you will.

That was ten years ago this January. IBM still exists, albeit bruised and battered, and it doesn't just sell typewriters. (In fact, it has spun off that business.) And Macintosh has not dominated the personal computer market (unless you count Windows machines as Macintoshes).

Looking back, I have to wonder what we could have done to achieve our goals—Machiavellian as they may have been. Here are a few ideas.

The Early Days

We should have shipped Macintosh with 256K of RAM. We lived under two misconceptions: (1) that 128K was an ocean of RAM (compared with an Apple II, it was); and (2) that every Macintosh programmer would be as good as Andy Hertzfeld, so more RAM wasn't necessary. If the first Macintosh had shipped with 256K of RAM, there would probably have been Macintosh software six to nine months earlier. Lesson: You can never have too much RAM, and you can never underestimate the difficulty of learning to program a new computer.

We should have designed slots into the second version of Macintosh. Unfortunately, we were so exhausted, exhilarated, and stubborn that development sputtered for a year. Steve Jobs passionately disapproved of slots despite the demands of early buyers, because he wanted people to be able to open the box, plug it in, and go. Lesson: Buyers can't help you create a revolutionary product, but they can tell you how to evolve one.

We should have unbundled Mac-

Write in the middle of 1984. Initially, bundling MacWrite was supposed to last for the first 100 days. However, when it became clear that fewer people might buy Macintosh if they had to pay for MacWrite and MacPaint, bundling continued for months. Unfortunately, this delayed good Macintosh word processors for years. I consider myself a good evangelist, but my pitch, "Write a word processor for Macintosh, and just ignore the fact that we give one away with every computer,"



didn't cut it. As it is, we're still muddling along with an outdated, anemic version of Microsoft Word completely dominating Macintosh word processing. Lesson: If you're asking someone to help you, inspire them; don't compete with them.

The Windows Menace

We should have launched the legal missiles at Microsoft when they first showed us Windows. Instead we wimped out when Gates threatened to stop working on Macintosh applications if Apple didn't license the look and feel of Macintosh to

Microsoft. Clint Eastwood had the right response: "Go ahead. Make my day." Gates was bluffing—and if he wasn't bluffing, he would have changed his mind because he was making too much money on Macintosh applications. Lesson: It's better to be feared than to be fooled.

Apple should have licensed source code to Macintosh to all comers in 1989 or 1990—when Macintosh was hot and Windows was not. Imagine if John Sculley had cocked his .44 magnum and told Gates, "We're going to sue you for copyright infringement, and we're going to license Macintosh source code to every hardware manufacturer in America. There will be a legal cloud over Windows for years, and the manufacturers will be able to get The Real Thing instead of a clunky imitation." Lesson: If you're packing a bigger gun, don't be afraid of a shoot-out.

Apple should have launched a frontal assault on Windows—lawsuit or not—while simultaneously lowering the street price of an entry-level Macintosh to under \$1000. Aside from a few ads last year (too little, too late), Apple hasn't made it clear that Macintosh blows Windows away. We needed industrial-strength mudslinging, early on, while seeding the market with loss-leader Macintoshes to produce Quadra-lusting, upgradin', long-run customers. Instead, we got namby-pamby "positioning" encumbered by the fear of offending the largest Macintosh application software provider.

Looking Back

Hindsight is always perfect. The point is not that we blew it. The point is that we came so close (most pundits predicted the death of Macintosh between 1985 and 1987), and that we should learn from our mistakes so that someday the whole world will dream in six colors. **m**

GUY KAWASAKI's views are his own and only sporadically represent those of *Macworld*. His current book, *Hindsight*, will be published by Beyond Words Publishing in January. He has investments in Bit Jugglers, Global Village Communication, Bookmaker Corporation, and others. He can be reached at Kawasaki@radiomail.net.

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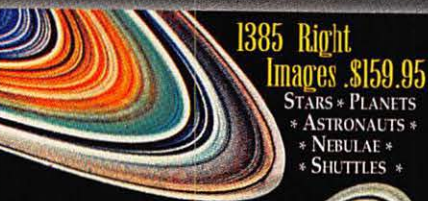
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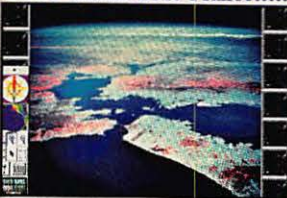
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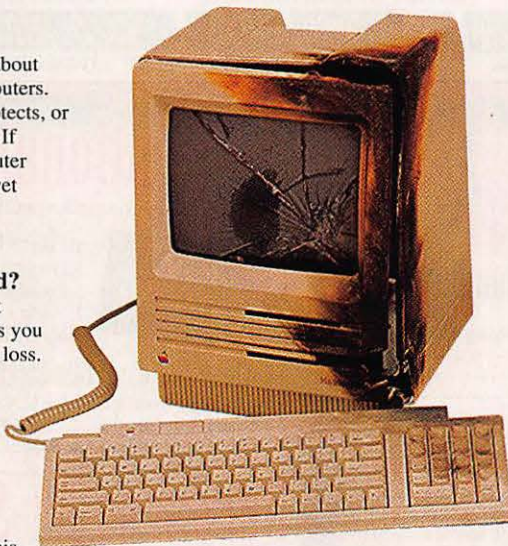
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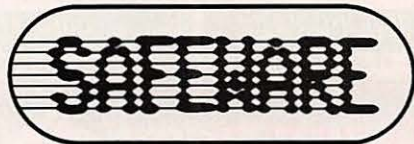
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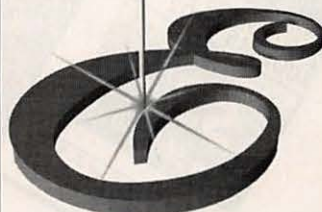
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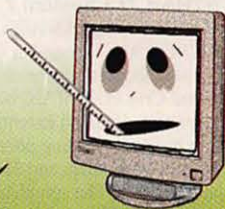
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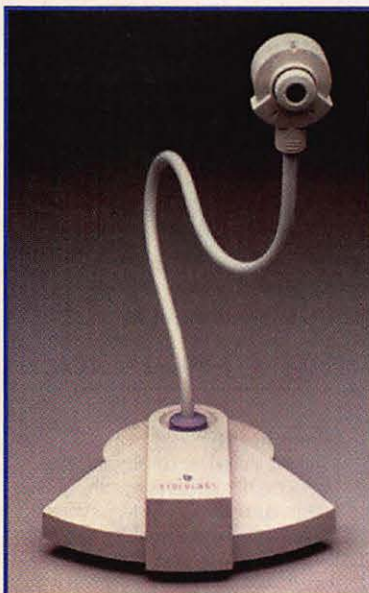
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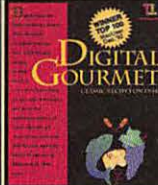
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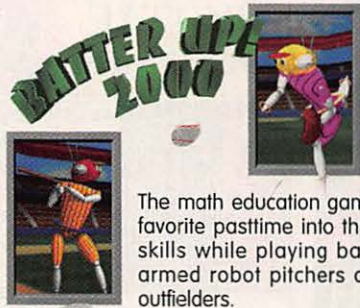
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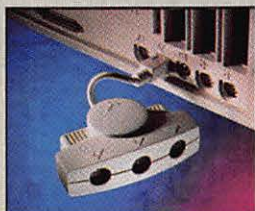
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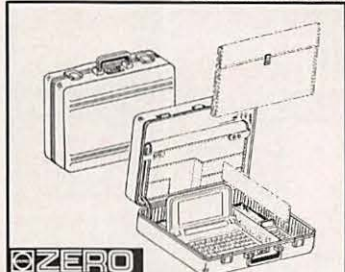
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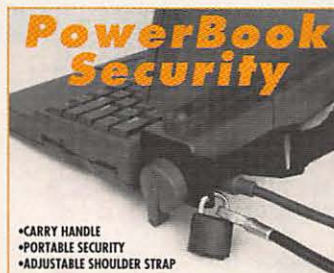
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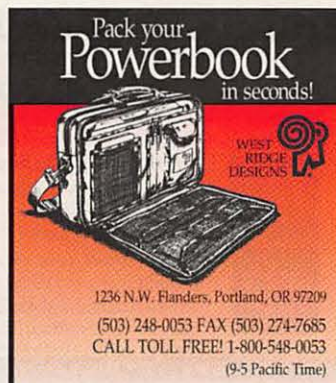


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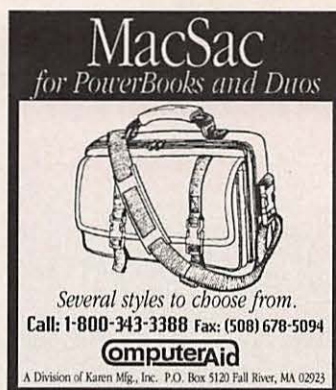
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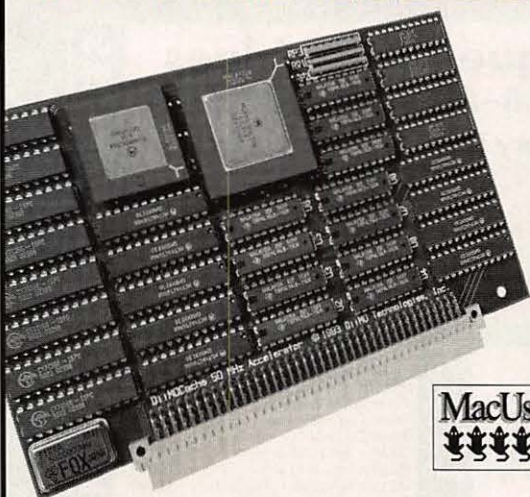
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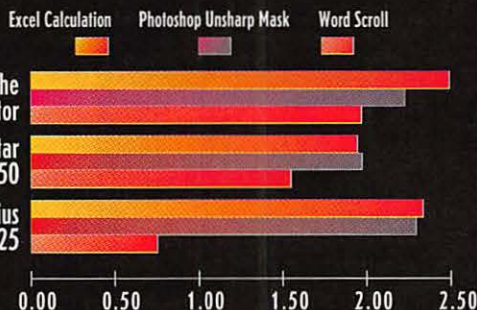
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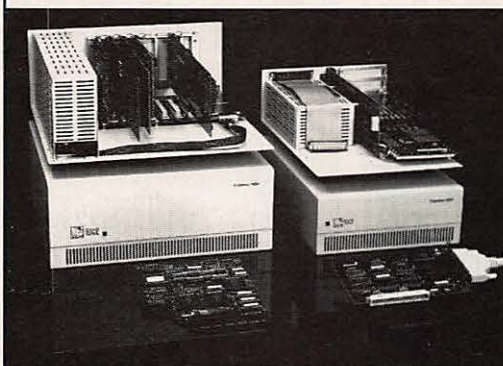
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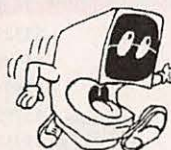
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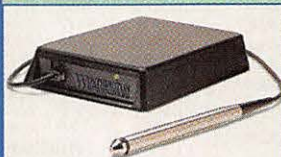
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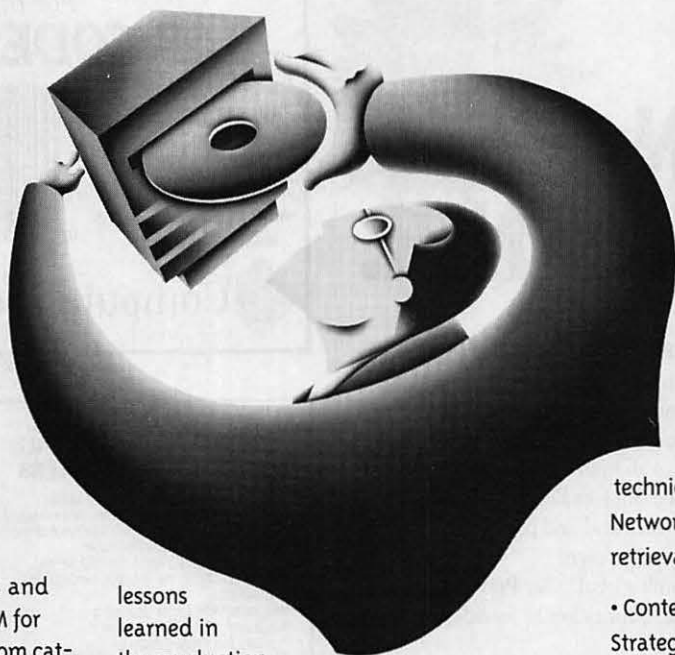
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1.2GIG	M2694	3.5" Half Height	8.5ms	995mb	\$959	\$1019
2.4GIG	M2654	5.25" Full Height	11.5ms	2000mb	\$1629	\$1729

* One Year Warranty

Seagate



Unformatted Capacity	Model	Description	Access Time	Actual MAC Capacity	Internal	External
3.5" HALF HEIGHT						
1.2GIG	ST11200N		10.5ms	1000mb	\$939	\$999
2.4GIG	ST12400N		9ms	2000mb	\$1699	\$1759
1.9GIG	ST11950N	Barracuda 1	8ms	1350mb	\$1599	\$1659
2.4GIG	ST12550N	Barracuda 2	8ms	2050mb	\$1949	\$2009

5.25" FULL HEIGHT

1.6GIG	ST41651N	Wren-8	15ms	1350mb	\$1165	\$1265
2.1GIG	ST42100N	Wren-9	12.9ms	1900mb	\$1485	\$1585
2.4GIG	ST42400N	Elite-2	11ms	2050mb	\$1799	\$1899
3.4GIG	ST43400N	Elite-3	11ms	2750mb	\$2219	\$2319

Seagate drives carry a ONE Year Warranty.

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ClubMac 44mb Internal	\$259	ClubMac 88c Internal	\$405
ClubMac Dual 44mb	\$549	ClubMac Dual 88c	\$779

105MB REMOVABLES CARTRIDGES

ClubMac 105mb External	\$429	44mb/105mb	\$59
ClubMac 105mb Internal	\$389	88mb	\$89

ClubMac 105mb Internal for Quadra 900/950 only.

ClubMac Dual 105mb \$769**

* ClubMac Dual 88c includes ONE 88mb cartridge only.
** ClubMac Dual configurations include a single cartridge.

All SyQuest drives include a TWO Year Warranty, SCSI Director formatting software, and necessary cables for "plug-and-play". All SyQuest cartridges include a ONE Year Warranty.

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3-5GIG	Archive Turbo DAT*	4mm	\$1255	\$1275
2.0GIG	Hewlett Packard 35470A	4mm	\$1079	\$1099
3-5GIG	Hewlett Packard 35480A*	4mm	\$1179	\$1199
4-10GIG	Sony SDT-5000	DDS-2	\$1379	\$1399

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December 1993
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Part Number	Model	Capacity	Description	Seek	Internal	External
CMO-DynaMo	Fujitsu	128mb	3.5" LP	35ms	\$849	\$879
CMO-M2511A	Fujitsu	128mb	3.5" LP	35ms		\$879
CMO-OMD5010	Epson	128mb	3.5" HH	45ms		\$779
CMO-JY750	Sharp	594/652mb	5.25" HH	40ms	\$1669	\$1699
CMO-C1716T	HP	1.3GIG	5.25" FH	24ms		\$2729
128mb / 600mb / 1.3GIG Cartridge						\$35/95/125

All ClubMac Opticals include ONE cartridge and ONE Year Warranty.



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MicroWriter PS23	699	840 Flatbed	1225
MicroWriter PS65	989	630 Flatbed	1075
Microlaser PS 17	829	630LE Greyscale	599
Microlaser PS 35	875	630LE & Transparency	1539
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All TI Accessories Available	Call	Auto Document Feeder	425

TI Pro 600 PS23 \$1375

1260 Flatbed \$1809



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Turbo 040i 33MHz	739
Value 040 40MHz	1225
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50MHz Powercache SE/30	568
50MHz PowerCache	549
Diskrunner	569



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Thunder 24	2149
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SuperMatch Hi Res 20" Trin.	2699
Spectrum /24 PDQ Plus	1295

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Now Utilities v4.0	77

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MacInsider Multidisk 150	469
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DEC 1.0 GB	1029
PMO 605 Mac Ext.	2799
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Seagate 2.0GB	1999
Toshiba 340 PowerBook	649
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PLI Infinity 88RW44 \$489

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Global Village Bronze	99
Hayes Optima 14.4+v.32bis	409
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520MB	3.5"	9MS	\$ 575	\$ 635	
1.2GIG	3.5"	8.5MS	\$ 850	\$ 910	
2.4GIG	5.25"	11.5MS	\$ 1550	\$ 1610	

Seagate		5 YEAR WARRANTY			
CAPACITY	SIZE	ACCESS	INTERNAL	EXTERNAL	
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600MB*	3.5"	10.5MS	\$ 839	\$ 889	
1.2GIG	3.5"	9MS	\$ 899	\$ 949	
1.6GIG*	5.25"	15MS	\$ 1149	\$ 1249	
2.2GIG*	5.25"	12MS	\$ 1429	\$ 1529	
2.4GIG	5.25"	11MS	\$ 1729	\$ 1829	
2.4GIG	3.5"	9MS	\$ 1695	\$ 1755	
2.5GIG	3.5"	8MS	\$ 1949	\$ 1999	
3.4GIG	5.25"	10MS	\$ 2169	\$ 2269	

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CAPACITY	SIZE	ACCESS	INTERNAL	EXTERNAL	
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500MB	Sankyo CP-525	DC6250	\$ 565	\$ 625	
750MB	Exabyte 2501	DC2750	\$ 626	\$ 686	
1.3-2GIG	Archive 4320*	4MM	\$ 939	\$ 999	
1.3-8GIG	Archive Turbo*	4MM	\$ 1139	\$ 1199	
1.3-2GIG	Exabyte 4200*	4MM	\$ 939	\$ 999	
1.3-5GIG	Exabyte 8205	8MM	\$ 1539	\$ 1599	
1.3-10GIG	Exabyte 8505	8MM	\$ 2224	\$ 2379	
4.0-8GIG	Sony 4000	4MM	\$ 1089	\$ 1149	
4.0-8GIG	Sony 5000 DDS-2	4MM	\$ 1189	\$ 1249	

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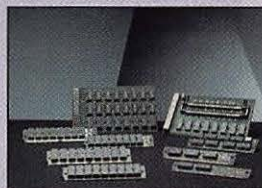
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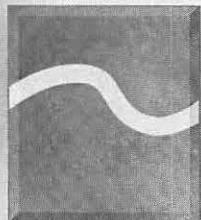
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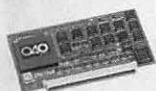
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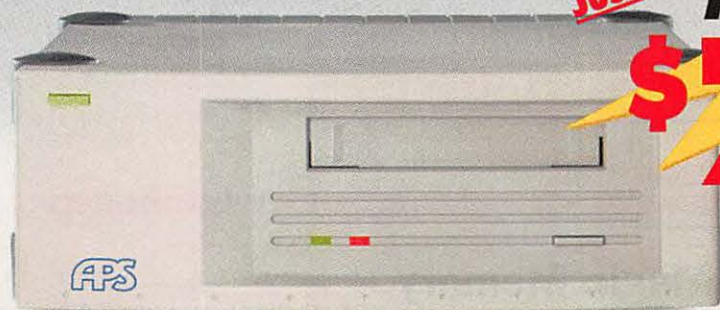
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APS GRS 160 ¹	349	299	429
APS T 213 ¹	449	349	529
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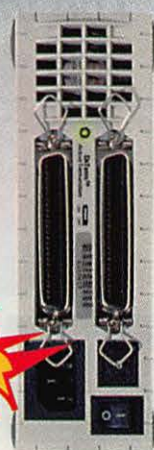
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Model	Internal	ZFP	SR2000
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Quantum 127ELS mechanism

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APS MX 245² 259 329 349
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Model	Internal	ZFP	SR2000
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APS MX 345² \$379 \$449 \$469
Maxtor 7345 mechanism

APS Q 540² 749 819 839
Quantum Lps540 mechanism

APS MX 540² 749 819 839
Maxtor MXT540 mechanism

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APS MS 1.2AV⁵ 1099 1169 1189
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Model	Internal	ZFP	SR2000
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Maxtor MXT1240S mechanism

APS ST 1.6⁵ 1599 — 1699
Seagate ST 11950N mechanism

APS MS 1.7⁵ 1349 1419 1439
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Micropolis 2217S mechanism

APS ST 2.0⁵ 1929 — 2029
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APS MS 2.4G⁵ 1999 *2099 —
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340MB	12ms	\$329	\$389
525MB	10ms	\$589	\$649
PRO Series			
700MB	10ms	\$779	\$839
1.0GB	10ms	\$909	\$969
1.2GB	10ms	\$1066	\$1126
1.8GB	10ms	\$1270	\$1330
GO-Series			
80/85MB	17ms	\$191/219	\$251/279
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Fujitsu	128MB	35ms	\$899	\$929
Fujitsu	128MB	45ms	\$769	\$799

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40MHz	\$379	\$505
6400 Series - for IIsi, Ilic, Ilii, Ilix & Performa 600		
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33MHz	\$919	
40MHz	\$1109	
DataLink PB	\$469	
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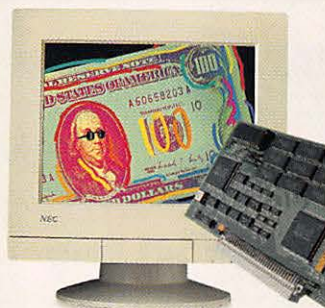
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7354 Flo'

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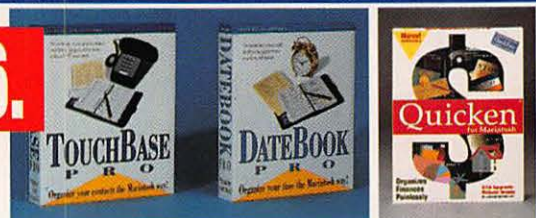
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Aldus Consumer Division

7056 DATEBOOK PRO, TOUCHBASE PRO, and Quicken 4 Bundle

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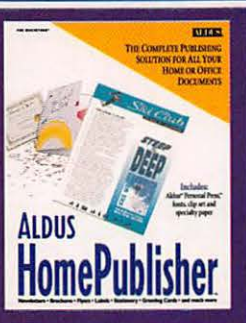
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Here's the perfect solution for every home or office publishing job. Aldus HomePublisher is the easy and complete publishing program that lets you turn out first-class publications - newsletters, brochures, flyers, labels, calendars, and much more. In just minutes, your home or business documents are ready to print. Aldus HomePublisher includes Aldus Personal Press for desktop publishing, full-featured word processing, image control, templates, and copy-fitting. Plus you get a selection of 12 sharp-looking fonts from Bitstream, 100 ClickArt images from T/Maker, and a package of PaperDirect specialty paper - everything you need to create eye-catching documents for all occasions. This is truly a complete publishing solution for all your home or office documents.

Minimum requirements: Mac Plus, 2MB RAM, System 6.0.7, hard disk.

Aldus Consumer Division

7245 Aldus HomePublisher



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Minimum requirements: Mac Plus, 2MB RAM, System 6.0.7.

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6689/6718 IN CONTROL Bundle

ATTAIN

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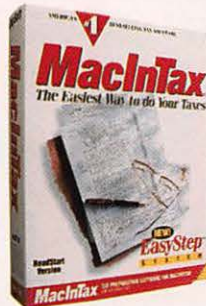
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Tax preparation without the headaches! MacInTax makes preparing your taxes easier, faster, and more accurate than ever before. Only MacInTax has EasyStep, which leads you through your tax return from start to finish, guiding you every step of the way. MacInTax contains everything you need to do your taxes quickly and accurately. Get started early with MacInTax HeadStart Edition. Buy the HeadStart version now and get the final version with IRS final approved forms free in January. MacInTax will transfer your information to the new forms automatically. Or get MacInTax and Quicken together and stay on top of your finances year 'round. Minimum requirements: Mac Plus, 1MB RAM, floppy drive, System 6.0.5, and a hard disk. Supports color and monochrome monitors.

Chipsoft

7221 MacInTax Headstart Edition (pictured)

7223 MacInTax/Quicken Bundle \$54.



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Greg LeMond's Bicycle Adventure is an interactive voyage around the world. Experience the role of bicycling in other societies. Every trip is a different experience! GOLF Who What Why When Where will give you a new perspective on this most compelling sport. And you get Lee Trevino's Priceless Golf Tips video, FREE.

Minimum requirements: LCII, 5MB RAM, System 7, 13" 256 color monitor, CD-ROM drive.

Eden Interactive

6921 Greg LeMond's Bicycle Adventure (Mac & DOS) (pictured)

6922 Greg LeMond's Bicycle Adventure CD-ROM (Mac only)\$48.

6923 GOLF Who What Why When Where CD-ROM (Mac & MPC)\$48.



\$32.

Lights Out Sports Fans

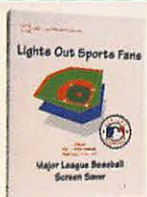
Every baseball fan should have this screen saver to prevent screen burn-in. Choose from ten "game plan" modules and control aspects of each. Watch a simulated baseball game played out using actual baseball statistics in the Game Time module. You pick which teams play. Or watch a carnivorous blimp prowling the sky devouring team logos.

Minimum requirements: 1.3MB RAM, System 6.0.5.

Quadangle

6929 Lights Out Sports Fans (pictured)

7365 Lights Out Sports Fans - Hockey\$32.



\$36.

Spin Doctor

Swing, flip, and bounce past enemies in Spin Doctor, the arcade-style, animated game of skill. Navigate through a 100-level, moving obstacle course of nasty rotating wands, spikes, acid droplets, moving doors, fuses, bombs, and much more in amazing 256-color animation. Spin Doctor is unlike any game you've ever seen - a game addict's dream!

Minimum requirements: Any Mac supporting 256 colors or gray scale.

Callisto

7028 Spin Doctor



\$39.

Pathways Into Darkness

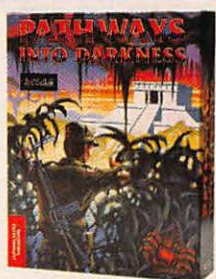
Think fast! You'll have to if you're going to keep up with continuous-motion, 3D, texture-mapped graphics, and defeat an alien demon. Separated from your secret special forces team, you travel over 4 million square feet alone to save the world. Beautifully rendered graphics and active panning stereo sound combine to make Pathways Into Darkness the closest thing to virtual reality without a helmet. And, the smooth-scrolling, first-person interface works well with any 256-color Mac. If you need a little help on your mission, the Official Pathways Into Darkness Hint Book guides you through Pathways' levels, monsters, and strategies. Plus, you get maps, tips, and a level by-level walk-through.

Minimum requirements: Any 256 or 8-bit color Mac, 1MB RAM, System 6.0.5, 5MB hard disk space.

Bungle Software

6639 Pathways Into Darkness (pictured)

7367 Official Pathways into Darkness Hint Book\$13.



\$49.

FLOWERscape

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Minimum requirements: Any Mac with a 256-color monitor and high-density floppy drive, 1.5MB RAM, System 6.0.4, 8.5MB hard disk space.

Voudette

6701 FLOWERscape-Mac (pictured)

6702 FLOWERscape-Windows\$49.



\$28.

Star Trek The Screen Saver

Beam out burn-in. Eddy award winner Star Trek The Screen Saver prevents burn-in with over 15 displays of Tribbles, Captain Kirk, Spock, and more. It's a stand alone product and fully compatible with After Dark's more than 30 displays.

Minimum requirements: Star Trek - Mac Plus, 2MB RAM, System 6.0.4. After Dark - Mac 512KE, 512K RAM.

Berkeley Systems

5341 Star Trek The Screen Saver (pictured)

1232 After Dark\$28.

3523 After Dark & More

After Dark Bundle\$39.



\$41.

ReadySetGrow!

ATTENTION PARENTS! This fun, interactive guide combines animation, illustrations, sound effects, and text to cover parenthood from prebirth to age 5. Explore Family Profile to help "predict" your child's looks or determine potential risks. Medical Records with electronic growth charts, "Biological Clock," Pregnancy Timetable, and much more make this the most comprehensive parents' program available.

Minimum requirements: Any Mac with 1MB RAM, System 6.0.5, hard drive.

Atlantis

6991 ReadySetGrow! (pictured)

6992 ReadySetGrow! Windows\$41.



\$39.

Sailing Master

Don your sailing cap and deck shoes as you race against your Mac and learn how to sail without getting wet. Sail against as many as three boats, and learn about wind shifts. Course options, skill levels, hazards, and other features offer a challenge for land lubbers and old salts alike. "Sailing Master is a lot of fun - well worth the price," says Macworld. (Nov. '93)

Minimum requirements: Mac 512K.

Starboard Software

5318 Sailing Master



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Minimum requirements: Mac LC, 4MB RAM, System 7.0, hard drive, color monitor with 8-bit graphics.

MAXIS

6692 SIM City 2000



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Minimum requirements: Mac Plus, 2MB RAM, System 6.0.5., a hard disk.

Microsoft

5645 Microsoft Office 3.0 \$458.

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Microsoft®



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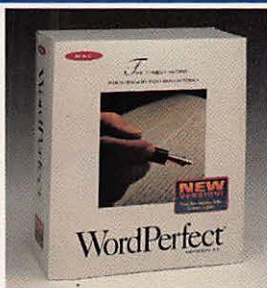
Minimum requirements: Mac Plus, 2MB available RAM,

System 6.0.7, hard drive, 4MB RAM under System 7.

WordPerfect

6681 WordPerfect 3.0 (pictured)

6874 WordPerfect 3.0 Competitive Upgrade \$78.



**WordPerfect
macintosh**

Tempo EZ Tempo II Plus 3.0

Yes, macros make life on the Mac easier, but finding an easy Macro *maker* isn't always – well, easy. With **Tempo EZ**, creating macros is as simple as 1 – Start recording, 2 – Perform the steps, and 3 – Save. That's it. You simply combine keystrokes and/or mouse clicks into one macro. Then, a keystroke, a click, or a couple of characters – that's all it takes to play a macro. For more macro-making power, get **Tempo II Plus 3.0**. It offers the highest degree of automation and even sets up conditional testing. You can create "interactive" macros to determine when to back-up your database, which files to batch-process, how to format a document, and much more.

Minimum requirements: Mac Plus, 1MB RAM, System 6.2

\$98.



\$48.



Affinity

6910 Tempo EZ \$48.

6534 Tempo II Plus 3.0 \$98.

\$224.

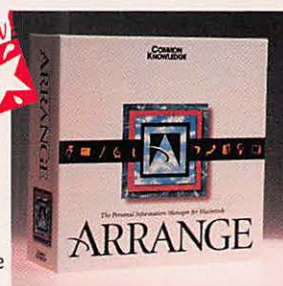
Arrange

Arrange is a *fully*-integrated Personal Information Manager that lets you organize contacts, schedules, to-do lists, projects, files, and much more. A powerful "drag-and-drop" interface, intelligent importing, and automatic merging and sorting make it quick and easy to use. A library of professional templates is available, or customize your own for totally personal solutions. If you use large databases, you'll appreciate the Smart Import which simplifies information access. The Grabber system extension lets you quickly gather just the on-line information you need. Automatic file synchronization simplifies home, office, and mobile information management. And it maximizes your PowerBook's performance with a Sleep feature and RAM optimization.

Minimum requirements: Mac II, 2MB RAM, System 6.0.7, hard drive.

Common Knowledge

7215 Arrange



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Business Standard

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Minimum requirements: Mac Plus, 1MB RAM, System 6.0.7.

CHAE

7057 Business Standard



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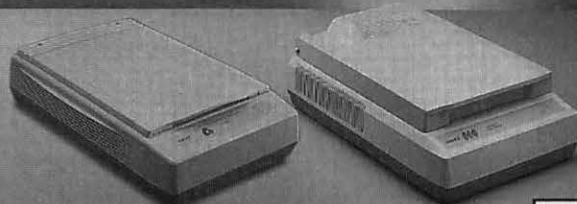
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Supra Fax Modem 14.4 V.32 bis (ext.)	269
Supra Fax Modem 96/96 (ext.)	249
PSI Comstation Four	339
PSI Comstation Five	409
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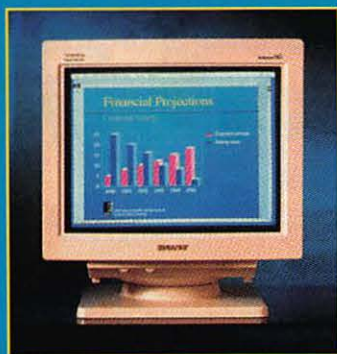
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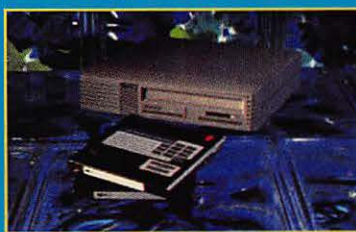


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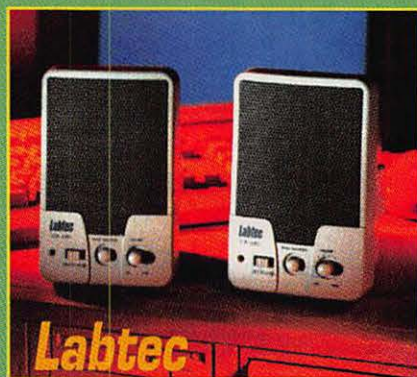
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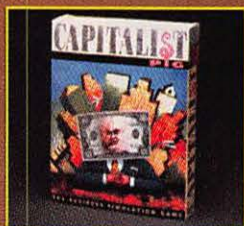
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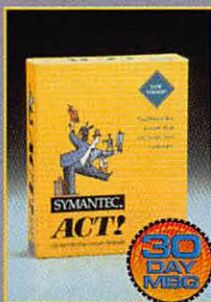


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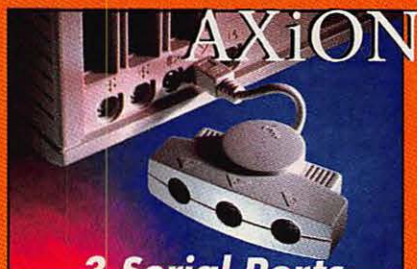


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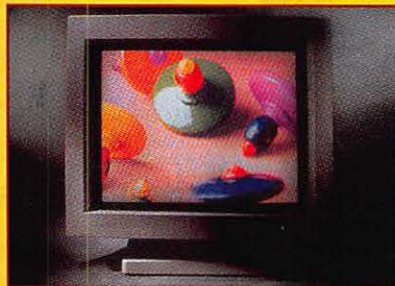
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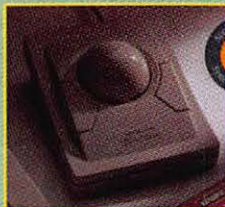
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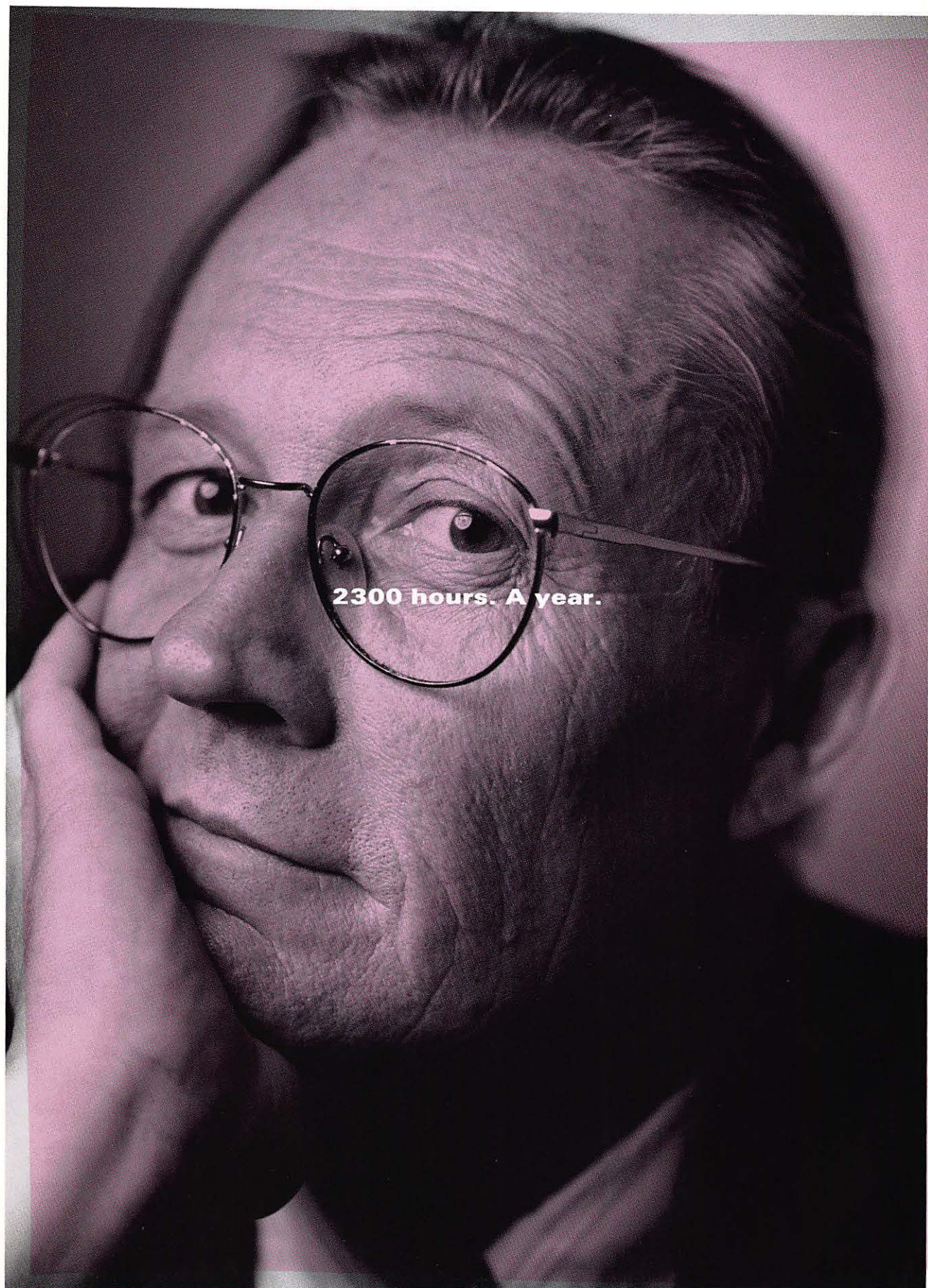
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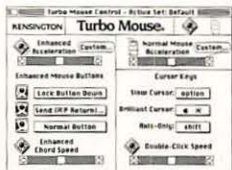
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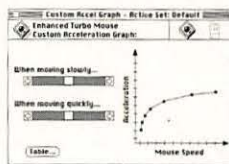


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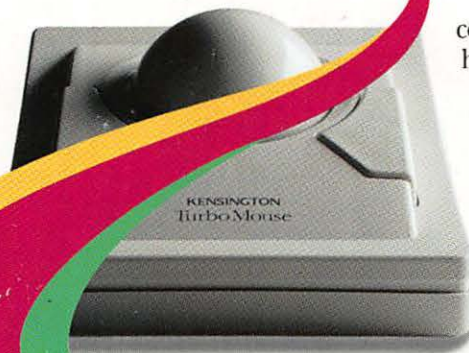


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